ALASKA POLLUTANT DISCHARGE ELIMINATION SYSTEM

PERMIT FACT SHEET – DRAFT

Permit Number: AK0053333

AURORA ENERGY, LLC - CHENA POWER PLANT

ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION
Wastewater Discharge Authorization Program
555 Cordova Street
Anchorage, AK 99501

Public Comment Period Start Date: August 25, 2017
Public Comment Period Expiration Date: October 11, 2017
Public Meeting: 5:30 - 6:30 p.m.
Public Hearing: 6:30 - 8:00 p.m.
Date: September 28, 2017
Location: Westmark Fairbanks Hotel and Conference Center, Rampart Room
813 Noble Street
Fairbanks, Alaska 9970
Alaska Online Public Notice System

Technical Contact: Angela Hunt
Alaska Department of Environmental Conservation
Division of Water
Wastewater Discharge Authorization Program
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Proposed reissuance of an Alaska Pollutant Discharge Elimination System (APDES) permit to

AURORA ENERGY, LLC

For wastewater discharges from

Chena Power Plant
1206 1st Avenue
Fairbanks, Alaska, 99701

The Alaska Department of Environmental Conservation (the Department or DEC) proposes to reissue APDES individual permit AK0053333 – Aurora Energy Services – Chena Power Plant. The permit authorizes and sets conditions on the discharge of pollutants from this facility to waters of the United States. In order to ensure protection of water quality and human health, the permit places limits on the types and amounts of pollutants that can be discharged from the facility and outlines best management practices to which the facility must adhere.

This fact sheet explains the nature of potential discharges from the Chena Power Plant and the development of the permit including:

- information on public comment, public hearing, and appeal procedures
- a listing of proposed effluent limitations and other conditions
- technical material supporting the conditions in the permit
- proposed monitoring requirements in the permit

Public Comment

Persons wishing to comment on, or request a public hearing for the draft permit for this facility, may do so in writing by the expiration date of the public comment period.

Commenters are requested to submit a concise statement on the permit condition(s) and the relevant facts upon which the comments are based. Commenters are encouraged to cite specific permit requirements or conditions in their submittals.

A request for a public hearing must state the nature of the issues to be raised, as well as the requester's name, address, and telephone number. The Department is holding a public hearing as described above on the first page of this Fact Sheet to generally go over the permit along with specific focus on the Clean Water Act Section 316(a) Thermal Variance proposed to be authorized by the permit. A public hearing will be held at the closest practicable location to the site of the operation. If the Department holds a public hearing, the Director will appoint a designee to preside at the hearing. The public may also submit written testimony in lieu of or in addition to providing oral testimony at the hearing. The hearing will be tape recorded. Details about the time and location of the hearing are provided in the separate public notice for the permit.

All comments and requests for public hearings must be in writing and should be submitted to the Department at the technical contact address, fax, or email identified above (see also the public comments section of the attached public notice). Mailed comments and requests must be postmarked on or before the expiration date of the public comment period.

After the close of the public comment period and after a public hearing, if applicable, the Department will review the comments received on the draft permit. The Department will respond to the comments received in a Response to Comments document that will be made available to the public. If no substantive comments are received, the tentative conditions in the draft permit will become the proposed final permit.

The proposed final permit will be made publicly available for a five-day applicant review. The applicant may waive this review period. After the close of the proposed final permit review period, the Department will make a final decision regarding permit issuance. A final permit will become effective 30 days after the Department's decision, in accordance with the state's appeals process at 18 AAC 15.185.

The Department will transmit the final permit, fact sheet (amended as appropriate), and the Response to Comments to anyone who provided comments during the public comment period or who requested to be notified of the Department's final decision.

The Department has both an informal review process and a formal administrative appeal process for final APDES permit decisions. An informal review request must be delivered within 15 days after receiving the Department's decision to the Director of the Division of Water at the following address:

Director, Division of Water
Alaska Department of Environmental Conservation
410 Willoughby Street, Suite 303
Juneau AK, 99811-1800

Interested persons can review 18 AAC 15.185 for the procedures and substantive requirements regarding a request for an informal Department review.

See http://dec.alaska.gov/commish/InformalReviews.htm for information regarding informal reviews of Department decisions.

An adjudicatory hearing request must be delivered to the Commissioner of the Department within 30 days of the permit decision or a decision issued under the informal review process. An adjudicatory hearing will be conducted by an administrative law judge in the Office of Administrative Hearings within the Department of Administration. A written request for an adjudicatory hearing shall be delivered to the Commissioner at the following address:

Commissioner
Alaska Department of Environmental Conservation
410 Willoughby Street, Suite 303
Juneau AK, 99811-1800

Interested persons can review 18 AAC 15.200 for the procedures and substantive requirements regarding a request for an adjudicatory hearing. See http://dec.alaska.gov/commish/ReviewGuidance.htm for information regarding appeals of Department decisions.

Documents are Available

The permit, fact sheet, application, and related documents can be obtained by visiting or contacting DEC between 8:00 a.m. and 4:30 p.m. Monday through Friday at the addresses below. The permit, fact sheet, application, and other information are located on the Department's Wastewater Discharge Authorization Program website: http://dec.alaska.gov/water/wwdp/index.htm.

Alaska Department of Environmental Conservation
Division of Water
Wastewater Discharge Authorization Program
555 Cordova Street
Anchorage, AK 99501
(907) 269-6285

Alaska Department of Environmental Conservation
Division of Water
Wastewater Discharge Authorization Program
610 University Avenue
Fairbanks, Alaska 99709
(907) 451-2100

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1.0 Applicant

This fact sheet provides information on the Alaska Pollutant Discharge Elimination System (APDES) permit for the following entity:

Name of Facility:	Chena Power Plant
APDES Permit Number:	AK0053333
Facility Location:	1206 1st Avenue, Fairbanks, Alaska 99701
Mailing Address:	100 Cushman Street, Suite 210, Fairbanks, Alaska 99701
Facility Contact:	Mr. Dave Fish

Outfall Location

Discharge Location (Outfall)	Receiving Water	Latitude	Longitude
001	Chena River	60.8480 North	147.7352 West

Figure A-1 in Appendix A shows the location of the facility and the discharge location.

2.0 Facility Information

The Chena Power Plant (CPP) is a coal-fired power plant that generates electricity, steam heat, and hot water for use by customers in downtown Fairbanks, Alaska. The CPP began operating in 1954 and was owned and operated by the Fairbanks Municipal Utility System until it was purchased by Aurora Energy (a subsidiary of the Usibelli Corporation) in 1998. The CPP currently operates four boilers and four turbine generators that are capable of generating up to 27.5 Megawatts (MW) of electrical power. Despite historically using groundwater for cooling purposes, the CPP now relies solely on river water. The CPP pumps approximately 20 million gallons of water per day (mgd) from the Chena River for use as non-contact cooling water (i.e., once through cooling water).

Water enters the CPP through two openings (5 feet by 5 feet) in the cooling water intake structure and collects in a central basin. The water flows through a screen at the opening of the intake structure and then through a travelling screen within the intake structure designed to trap debris before it reaches one of several pumps within the structure. Water is then pumped into the plant where it is used to cool the condensers or other types of equipment including air compressors, fan motor bearings, and feed water pump bearings. The remaining heated water is pumped to the outfall house and discharged back into the Chena River through a 36-inch single nozzle pipe positioned just above the river bottom that releases water perpendicular to the flow of the river (Outfall 001). During the winter months a small portion of the heated water is recirculated back to the intake structure and discharged slightly upstream to control ice-build up on the screen.

The CPP property is divided into two areas separated by the Chena River. The northern portion of the CPP consists of a coal-handling area with a conveyor belt that carries coal over the river to the main power plant to the south. The coal handling area includes a building for unloading coal, an enclosed coal crusher, and open storage piles. Approximately 210,000 tons of coal per year is brought to the CPP on railroad cars and is passed through a series of chutes that crushes it the correct size for use in the plant. The crushed coal is transferred to the plant on a conveyor belt equipped with catch bins to capture loose coal and coal dust. In 2006, Aurora Energy installed a full stream baghouse to control air emissions of coal dust. Coal ash is used as fill for various projects throughout Fairbanks. The southern portion of the CPP includes the main power plant, maintenance warehouse, cooling water intake structure, outfall house, and baghouse.

The non-contact cooling water is not exposed to equipment or materials that would introduce pollutants into the water. Laboratory testing in 2016 confirmed the absence of heavy metals, toxicants, or other pollutants in the discharge. However, the pH and temperature of the water fluctuate during processing and are the primary pollutants of concern discharged from the CPP.

3.0 Permit Background

The Fairbanks Municipal Utility System (original owners) initially submitted a National Pollutant Discharge Elimination System (NPDES) permit application to the Environmental Protection Agency (EPA) in the mid-1970s. In 1977, EPA prepared a draft NPDES permit authorizing discharges from the CPP to the Chena River, but the permit was never issued. The CPP operated under the conditions outlined in the draft permit until 2003 when EPA issued a NPDES permit for discharges of cooling water from the CPP to the Chena River. The 2003 NPDES permit established effluent limitations for daily flow, pH, temperature, and debris including floating solids, visible foam, and oily waste. The effluent limits were based on a thermal variance from Alaska Water Quality Standards (WQS) in accordance with Clean Water Act (CWA) §316(a) (see Appendix B for more information about CWA §316(a) and thermal variances). The permit also required monitoring of the effluent for flow, temperature, and pH and monitoring ambient river temperature and dissolved oxygen levels at a stationary location 800 feet downstream of the plant. The permit also required development of a monitoring program plan and best management practices plan.

In 2007, Aurora Energy submitted a request to modify the 2003 NPDES permit to EPA because the plant's output was expected to increase from 27.5 MW to 35 MW. Aurora Energy estimated an additional 10 mgd of water would be needed to accommodate the increased output. The proposed modifications to the permit included 1) increasing the maximum daily and monthly average "summer" effluent discharge temperature from 87.3°F (30.7°C) and 79.9°F (26.6° C) to 91.0°F (62.8°C), 2) increasing the flow from 20 mgd to 30 mgd, and 3) reassigning the month of May to the "summer" period. EPA did not modify the permit at that time. Later in 2008, Aurora Energy submitted an application for reissuance of the permit to EPA based on the assumption that the 2007 modification request was still under consideration. Before EPA acted on the permit application, the permit expired (September 30, 2008) and was administratively extended, remaining in force and effect since.

In October 2012, authority to administer the permitting action transferred from EPA to DEC. In 2015, Aurora Energy submitted an updated permit reissuance application to DEC that included a proposal to modify three effluent limits and a request for a regulatory mixing zone for temperature. The three modifications were similar to the ones requested in 2007 and included 1) increasing the average monthly effluent temperature in the summer to 90.0°F (32.2° C) and the daily maximum temperature to 95.0°F (35.0°C), 2) increasing the effluent volumetric flow to 30 mgd, and 3) reassigning the month of May to the "summer" period. DEC determined that a regulatory mixing zone for temperature was not feasible due to elevated ambient temperatures in the Chena River in the summer months and recommended that Aurora Energy evaluate a CWA §316(a) thermal variance.

In 2016, Aurora Energy submitted a revised permit application that requested to increase the volumetric flow to 24 rather than 30 as requested in 2015 and included a request for a CWA §316(a) thermal variance. The permit application also included several supporting studies including a scientific investigation that evaluated the potential impacts of the thermal plume of the local aquatic community, an antidegradation analysis, an antibacksliding analysis, and an assessment of potential impacts from the cooling water intake structure required by CWA §316(b) (see Appendix B for additional information on CWA §316(b) rules for cooling water intake structures).

4.0 Compliance History

DEC conducted routine inspections of the CPP in August 2004 and September 2015 to evaluate permit compliance. During the 2004 inspection, DEC reviewed the facility's records, toured the plant and coal loading area, and measured the temperature and conductivity of the Chena River upstream of the CPP and at the monitoring station 800 feet downstream of the outfall house. The temperature was 11°C (51.8°F) and the conductivity was 80 µS/cm, which suggests that the CPP complied with the effluent temperature limitation. The inspector found the records to be complete and the facility to be well maintained with no areas of obvious erosion or increased turbidity at the outfall.

As part of this permitting action, DEC also reviewed CPP's discharge monitoring reports (DMR) from January 2012 to June 2017 to evaluate the facility's compliance with effluent limits. The CPP reported two violations of the pH criteria (2013 & 2015), three violations of the average monthly effluent temperature during the summer of 2015 (May-July), and six instances of data collection failures (2013-2015). Aurora Energy suggests that the pH violations were due to low ambient pH rather than influences from the discharge and intends to contest the violations. The average monthly temperatures were exceed by 0.6°C (1.1° F) in May, 2.4°C (4.3°F) in June, and 1.9°C (3.4°F) in July.

In response to the exceedance of the monthly average effluent temperature occurring in May, DEC issued a Notice of Violation (NOV) to Aurora Energy in July 2015. In the NOV, DEC required Aurora Energy to adhere to permit effluent limits and submit a plan documenting how the permit limits would be achieved. According to Aurora Energy, multiple factors contributed to the noncompliance events including elevated ambient temperature of the intake water from the Chena River, reduced intake flow (pumps not able to maintain capacity during summer), accumulated debris and gravel content in the intake structure that blocked condenser tubes, and an inoperable pump. Aurora Energy's plan to prevent the reoccurrence of the noncompliance involves repairing the malfunctioning pump, dredging around the intake structure, and increased condenser cleaning.

In August 2016, DEC and Aurora Energy entered into an Interim Compliance Order by Consent (COBC) to provide for interim compliance measures to mitigate potential exceedances of the average monthly thermal effluent limit due to higher than normal river temperatures. The COBC explored the option of Aurora Energy adding up to 2,000 gallons per minute of groundwater or river water to the effluent whenever ambient river temperatures equals or exceeds 10.0°C (50.0°F) during the summer months of 2016, of which, Aurora Energy appears to have implemented on occasion to comply with effluent limits. The COBC also required Aurora Energy to submit to DEC a written report stating if additional water is combined with the effluent and explaining the circumstances that required the use of the interim compliance measure. In February 2017, the COBC was amended to allow Aurora Energy to continue to utilize the interim compliance measures for the months of May through September 2017 or until a new APDES permit is issued for the facility. The 2017 permit does not authorize Aurora Energy to add groundwater or river water to the effluent or use flow augmentation to lower the temperature of the discharge. Aurora Energy met the thermal effluent limitations during the summer of 2016 and 2017.

5.0 Effluent Limits and Monitoring Requirements

5.1 Basis for Permit Effluent Limits

The CWA requires that the limits for a particular pollutant be the more stringent of either technology-based effluent limits (TBEL) or water quality-based effluent limits (WQBEL). TBELs are set according to the level of treatment that is achievable using available technology. WQBELs are designed to ensure that the WQS of a water body are met. The permit contains both TBELs and WQBELs. The basis for the proposed effluent limits in the permit is provided in Appendix B.

CPP discharges non-contact cooling water to the Chena River from one outfall. EPA promulgated an update to the Steam Electric Power Generating Point Source Category Effluent Limit Guideline (ELG) at 40 CFR Part 423, which includes TBELs for steam electric power plants. For existing facilities, the ELG prohibits the discharge of polychlorinated biphenyl (PCB) and contains limits for chlorine discharged in once through cooling water. Because the CPP does not add chlorine, the prohibition of PCBs is the only limitation that applies to the discharge.

In order to determine if WQBELs are needed and to develop those limits when necessary, DEC typically conducts a reasonable potential analysis (RPA). The RPA is a water quality-based analysis that identifies the applicable water quality criteria, determines if there is a "reasonable potential" for the discharge to cause or contribute to an excursion of WQS in the receiving water, and develops an effluent limits, if needed. Based on the effluent limits in the previous permit and the facility's temperature performance monitoring data demonstrating permit limitation exceedances, DEC concluded there is "reasonable potential" for the effluent temperature to exceed WQS in the Chena River.

CWA §316(a) and the regulations at 40 CFR 122.21(m)(6) as well as state regulations at 18 AAC 70.220 provide for variances from strict compliance with thermal (i.e., temperature) water quality criteria. Aurora Energy analyzed the potential impact of the thermal discharge to the local aquatic community and found that a balanced, indigenous population would be maintained and protected under increased cooling water discharge volume and temperature limits. DEC proposes to grant a thermal variance per 18 AAC 70.220 for the facility's discharge of heated non-contact cooling water.

5.2 Basis for Effluent and Receiving Water Monitoring

In accordance with AS 46.03.110(d), the Department may specify in a permit the terms and conditions under which waste material may be disposed. Monitoring in a permit is required to determine compliance with effluent limits. Monitoring may also be required to gather effluent and receiving water data to determine if additional effluent limits are required and/or to monitor effluent impact on the receiving water body quality. The permittee is responsible to conduct the monitoring and report results on DMRs or on the application for reissuance, as appropriate, to the Department.

5.3 Limitations and Monitoring Requirements

Table 1 summarizes the proposed effluent limits and provides a comparison to the limits of the previous permit. The permit prohibits the discharge of biocides, metallic cooling water additives, PCBs, and residues that cause a film, sheen, or discoloration on the surface of the receiving water, within the water column, on the bottom, or upon the adjoining shoreline. Consistent with 40 CFR 124.57, if DEC determines that the alternative effluent limits proposed under CWA §316(a) cannot be granted, the facility discharge would be subject to the most stringent temperature WQS of 13°C (55.4°F) for protection of spawning areas and egg and fry incubation. The discharge shall not otherwise cause contamination of surface or ground water or contribute to a violation of the Alaska WQS.

Refer to Appendix B for more details regarding the legal and technical basis for selecting the effluent limits.

Table 1: Outfall 001 Effluent Limits and Monitoring Frequencies

Parameter	Units	Effluent Limits					
		Daily Maximum		Monthly Average		Monitoring Frequency	
		2003 Permit	2017 Permit	2003 Permit	2017 Permit	2003 Permit	2017 Permit
Total Discharge Flow, Winter	MGD	20	21	20	21	Continuous	Continuous
Total Discharge Flow, Summer	MGD	20	24	20	24	Continuous	Continuous
Temperature, Winter (Oct-Apr)	°C (°F)	25.6 (78.1) Oct-May	25.6 (78.1) Oct-Apr	22.6 (72.7) Oct-May	22.6 (72.7) Oct-Apr	Continuous	Continuous
Temperature, Summer (May-Sept)	°C (°F)	30.7 (87.3) June-Sept	35.0 (95.0) May-Sept	26.6 (79.9) June-Sept	32.2 (90.0) May-Sept	Continuous	Continuous
Polychlorinated Biphenyl	--	--	µg/L	Effluent	1/permit cycle[a]	Grab	Polychlorinated Biphenyl
pH	SU	6.5-8.5 at all times		6.5-8.5 at all times		1/week	1/week

Notes:

a. The monitoring must occur during the first year of the permit term.

5.4 Effluent Monitoring

The permit requires monitoring the effluent for flow, pH, temperature, and PCBs to determine compliance with the effluent limits. Monitoring flow and temperature must occur on a continual basis, except when performing maintenance activities or process changes. Monitoring pH must occur on a weekly basis. Monitoring for PCBs must take place at least once during the first year of the permit cycle. Monitoring frequencies are based on the nature and effect of the pollutant, as well as a determination of the minimum sampling necessary to monitor the facility's performance. The permittee must collect additional effluent samples whenever any discharge occurs that may reasonably be expected to cause or contribute to a violation that is unlikely to be detected by a routine sample.

The permittee also has the option of taking more frequent samples than required under the permit. These additional samples can be used for averaging if they are conducted using the Department – approved significantly sensitive test methods (generally found in 18 AAC 70 and 40 CFR Part 136 [adopted by reference in 18 AAC 83.010]), and if the Method Detection Limits (MDLs) are less than the effluent limitations.

5.5 Receiving Water Body Monitoring Requirements

The permit requires the permittee to monitor the receiving water at the intake structure and two downstream monitoring locations. The permittee must monitor the ambient temperature in the receiving water at the intake structure on a continual basis. Once per month during the winter months (October – April), the permittee must monitor the ambient temperature and the dissolved oxygen at the existing monitoring station 800 feet downstream of the outfall and a new downstream monitoring station located where the effluent and the receiving water is expected to be fully mixed under normal weather conditions. Once per week during the summer months (May – September), the permittee must monitor the ambient temperature and dissolved oxygen at the same two downstream monitoring stations. The permit requires the applicant to seek written approval from DEC regarding the location of the new downstream monitoring station before monitoring begins. Monitoring at the new discharge location must begin as soon as possible, but no later than May 2018, to allow the applicant time to obtain approval of the new monitoring station. Monitoring at all locations must continue until the permit expires.

The 2003 EPA-issued NPDES permit stipulated that the receiving water monitoring station be located at a point 800 feet downstream of the outfall because it was believed that the effluent and the receiving water were completely mixed at or near that location. In addition to monitoring 800 feet downstream of the outfall, the 2017 APDES permit adds a requirement to monitor the receiving water downstream at a point where the effluent and the Chena River is expected to be fully mixed under normal weather conditions when considering the increased flow and temperature limits. The simulation model indicates the effluent will be fully laterally and vertically mixed with the receiving water approximately 2,000 feet downstream of the outfall. The purpose of adding a second receiving water monitoring station is to provide additional data to validate the thermal plume model prepared by the permittee to support the CWA §316(a) thermal variance request.

The permit also requires receiving water monitoring to evaluate impingement and entrainment impacts associated with the cooling water intake structure under permit Part 2.1 and to analyze the impacts associated with the thermal plume under permit Part 2.2.

6.0 Receiving Water Body

6.1 Description of Receiving Waterbody

The Chena River emerges in the White Mountains and drains the Yukon-Tanana Uplands. The watershed encompasses roughly 2,115 square miles and is typically divided into the Upper Chena and the Lower Chena areas. The river flows west until it meets the confluence with the Tanana River. Flow from the turbid Tanana River was blocked with construction of the Moose Creek Dike in 1945 and Moose Creek Dam in 1967. Later in 1980, the Chena River Lakes Flood Control Project further limited flows through Fairbanks. Because these projects blocked flow from the Tanana River, the Chena River transitioned into the clear-running stream it is today and is primarily fed by precipitation and subsurface flow. According to data from the United States Geological Survey station (15514000) located slightly upstream of the CPP, flows vary widely between highs of up to 3,000 cubic feet per second in the summer months and lows of 260 cubic feet per second in the winter months.

The Chena River supports numerous resident and anadromous fish populations. The Alaska Department of Fish and Game (ADF&G) *Catalog of Waters Important for Spawning, Rearing, or Migration of Anadromous Fishes* indicates that several anadromous fish species, including chinook and chum salmon, reside in the Chena River. However, field studies conducted in 2015 indicate that no spawning areas are present within the power plants' area of influence. Other fish species present in the Chena River include Arctic Grayling (*Thymallus arcticus*), northern pike (*Esox luscious linnaeus*), sheefish (*Stendous leucichthys nelma*), burbot (*Lota lota*), arctic lamprey (*Lampetra japonica*), slimy sculpin (*Cottus cognatus*), and lake chub (*Couesius plumbeus*).

The Chena River and adjacent public use areas provides easy access to year-round recreational opportunities including boating, kayaking, canoeing, swimming, fishing, and wildlife viewing during the summer. Winter activities, such as skijoring and snow machining, are available along the majority of the

Chena River but are limited near the CPP due to an open reach downstream of the outfall resulting from the thermal discharge.

6.2 Outfall Location and Description

CPP discharges non-contact cooling water through a single outfall located at 64.8480 north latitude and - 147.7352 west longitude. The outfall structure is a submerged, 36-inch diameter discharge pipe positioned on the river bottom that extends approximately to the center of the river channel.

6.3 Water Quality Standards

Regulations in 18 AAC 83 require that the conditions in permits ensure compliance with the Alaska WQS. Alaska's WQS are composed of use classifications, numeric and/or narrative water quality criteria, and an Antidegradation Policy. The use classification system designates the beneficial uses that each water body is expected to achieve. The freshwater beneficial uses include water supply, water recreation, and growth and propagation of fish, shellfish, other aquatic life, and wildlife. The numeric and/or narrative water quality criteria are the criteria deemed necessary by the state to support the beneficial use classification of each water body. The Antidegradation Policy ensures that the designated and existing water uses and the level of water quality necessary to protect the uses are maintained and protected.

Water bodies in Alaska are protected for all uses unless the water has been reclassified under 18 AAC 70.230 as listed under 18 AAC 70.230(e). The Chena River from the confluence of the Chena River and Chena Slough to the confluence of the Chena River and Tanana River has been reclassified and is exempt from meeting the drinking, culinary, and food processing designated use subclasses. Some water bodies in Alaska can also have site–specific water quality criterion per 18 AAC 70.235, such as those listed under 18 AAC 70.236(b). The Chena River does not have site-specific water quality criteria pursuant to18 AAC 70.235. The Chena River is protected for the following beneficial uses: water supply for agriculture, including irrigation and stock watering; water supply for aquaculture and industry; contact and secondary recreation, and growth and propagation of fish, shellfish, other aquatic life, and wildlife.

6.4 Water Quality Status of Receiving Water

Any part of a water body for which the water quality does not or is not expected to meet applicable WQS is defined as a "water quality limited segment" and placed on the state's impaired water body list. In *Alaska's Final 2010 Integrated Water Quality Monitoring and Assessment Report,* the Chena River is identified as a 303(d) listed water impaired by sediment from urban runoff. The Chena River was §303(d) listed in 1990 for turbidity, petroleum hydrocarbons, oils and grease, and sediment. DEC monitored the Chena River in 2005, 2007, and 2009 to evaluate petroleum hydrocarbon and sediment levels. Data showed that the river met WQS for petroleum hydrocarbons, but remained impaired by sediment. In the *2010 Integrated Report*, the petroleum hydrocarbon impairment was removed and the Chena River was listed for sediment only. CWA §303(d) requires states to develop a Total Maximum Daily Load (TMDL) management plan for a water body determined to be water quality limited. The TMDL documents the amount of a pollutant a water body can assimilate without violating a state WQS and allocates that load to known point sources and nonpoint sources. A TMDL for sediment has yet to be completed.

7.0 Antibacksliding

Antibacksliding refers to statutory and regulatory provisions that prohibit the renewal, reissuance, or modification of an existing permit that contains effluent limitations, permit conditions, or standards less stringent than those established in the previous permit unless certain conditions are met. Relaxed effluent limitations are allowed under 18 AAC 83.480, CWA §402(o), and CWA §303(d)(4). CWA §402(o) and 40 CFR 122.44(l) expressly prohibits backsliding from certain existing effluent limitations, provides exceptions to the prohibition, and includes a safety clause that provides an absolute limit on backsliding.

18 AAC 83.480(b)(2), which closely mirrors CWA §402(o)(2)(B)(i), provides exceptions to antibacksliding provisions if “information other than revised regulations, guidance, or test methods that would have justified the application of a less stringent effluent limitation is now available but was not available at the time of permit issuance”. The permit application submitted in 2000 was based on conditions that were not representative of the CPP’s full operating capacity during the summer months. At that time, it was not economically beneficial to operate the CPP at full capacity all year and as such, Aurora Energy generally did not operate part of the CPP (i.e., the “old side”) in the summer months. As a result, the 2000 permit application did not account for the effluent associated with operation of the “old side” of the facility. Before EPA issued the NPDES permit for the CPP in 2003, Aurora Energy began operating the entire facility throughout the year to meet increased energy demands and has restricted their output since 2003 to comply with permit limits.

In addition, CWA §402(o)(1) states that a permit may not be renewed, reissued, or modified to contain less stringent effluent limitations than the comparable effluent limitations in the previous permit except in compliance with CWA §303(d)(4). According to CWA §303(d)(4)(A), for waterbodies with water quality that does not meet applicable WQS (non-attainment waters), the effluent limitations may be revised under two conditions: 1) the revised effluent limitation must ensure the attainment of the WQS (based on the waterbody TMDL or wasteload allocation) or 2) the designated use which is not being attained is removed in accordance with the WQS regulations. The Chena River is in attainment of the temperature WQS and accordingly does not have an associated temperature TMDL; therefore, further evaluation under CWA §303(d)(4)(A) is not required.

According to CWA §303(d)(4)(B), for waterbodies with water quality that meets or exceeds the level necessary to support the waterbody’s designated uses (attainment waters), WQBELs may be revised as long as the revision is consistent with the State’s Antidegradation Policy. As noted above, the Chena River has water quality sufficient to support the waterbody’s designated uses for pollutants of concern related to the subject permitting action. The antidegradation analysis conducted for the discharge, described in Section 8.0 below, indicates that the relaxed effluent limits are consistent with the State’s Antidegradation Policy; therefore, further evaluation under CWA §303(d)(4)(B) is not required.

Even if the requirements of CWA §303(d)(4) and 18 AAC 83.480(b) are satisfied, 18 AAC 83.480(c) and CWA §402(o)(3) prohibit relaxed limits that would result in violations of WQS (including antidegradation, which is analyzed in the subsequent section) or ELGs. DEC proposes to grant the CPP a CWA §316(a) thermal variance from temperature water quality criteria based on a demonstration that a balanced, indigenous population would be maintained and protected (refer to Appendix B for a detailed summary of CWA §316(a) and the associated scientific study). The results of modeling conducted as part of the scientific study indicate the CPP will comply with effluent limitations (and by extension WQS) under critical receiving water conditions.

The permit contains three modified effluent limits. First, the effluent temperature limit was increased for the summer season. The new monthly average limit of 90.0°F (32.2°C) is based on adding the highest monthly 85th percentile receiving water temperature of 60.4°F (15.8° C) to the design temperature change of 30.0°F (16.7°C) for a monthly average effluent discharge of 90.0°F (32.2°C). The new daily maximum limit of 95.0°F (35.0°C) is based on the average maximum seven-day ambient river temperature and the daily mean discharge in the river during the summer months. During the summer months when the Chena River is experiencing high temperatures and low flow, the temperature change of the cooling water could exceed 30.0°F (16.7°C), causing the effluent to reach up to 95.0°F (35.0°C). According to the CWA §316(a) demonstration study, the new effluent limits are protective of the local balanced indigenous population (see Appendix D for a summary of the study) while allowing CPP to operate at its capacity throughout the year.

Second, the volumetric flow was increased from 20 mgd to 24 mgd to reflect the actual volumetric flow required at a temperature differential of 30.0°F (16.7°C) with the current configuration. Lastly, May will be considered a "summer" month, which better corresponds to the river's natural freeze/thaw cycle. Ambient receiving water temperature data collected by the CPP between 2006-2014 shows that the ambient temperatures in May are considerably higher than the other winter months and closely resemble ambient temperatures in September. Increased effluent temperatures in May is not expected to impact fisheries as the fully mixed temperature would remain below the most stringent WQS of 13°C (55.4°F). All other permit effluent limits, standards, and conditions in the reissued permit are at least as stringent, if not more so, than the previously issued permit and are consistent with 18 AAC 83.480. Accordingly, no further backsliding analysis is required for the permit issuance.

8.0 Antidegradation

CWA §303(d)(4) states that for water bodies where the water quality meets or exceeds the level necessary to support the water body's designated uses, WQBELs may be revised as long as the revision is consistent with the state's Antidegradation Policy. The Antidegradation Policy of the WQS (18 AAC 70.015) states that the existing water uses and the level of water quality necessary to protect existing uses must be maintained and protected.

The Department's approach to implementing the Antidegradation Policy, found in 18 AAC 70.015, is based on the requirements in 18 AAC 70 and the Department's *Policy and Procedure Guidance for Interim Antidegradation Implementation Methods*, dated July 14, 2010. This policy describes the procedures DEC uses to determine whether a waterbody, or portion of a waterbody, is classified as Tier 1, Tier 2, or Tier 3, where a higher numbered tier indicates a greater level of water quality protection. At this time, no Tier 3 waters have been designated in Alaska. In DEC's *Alaska's Final 2010 Integrated Water Quality Monitoring and Assessment Report*, the Chena River is listed as impaired by sediment but not by temperature or pH, the primary pollutants of concern for the CPP. Accordingly, this antidegradation analysis assumes that the discharge is to a Tier 2 waterbody.

The state's Antidegradation Policy in 18 AAC 70.015(a)(2) states that if the quality of water exceeds levels necessary to support propagation of fish, shellfish, and wildlife and recreation in and on the water, that quality must be maintained and protected unless the Department, after receiving from the applicant all information reasonably necessary to make a decision, allows the reduction of water quality for a zone of deposit under 18 AAC 70.210 (September 2009), a mixing zone under 18 AAC 70.240 (July 2003), or another purpose as authorized in a Department permit, certification, or other approval. The Department may authorize a reduction of water quality only after the applicant submits information in support of the application, and the Department must make five findings. The five findings and the Department's determination are as follows:

1. **18 AAC 70.015 (a)(2)(A)**. Allowing lower water quality is necessary to accommodate important economic or social development in the area where the water is located.

Based on the evaluation required per 18 AAC 70.015(a)(2)(D), the Department has determined that the most reasonable and effective pollution prevention, control, and treatment methods are being used and that the localized lowering of water quality is necessary.

CPP has provided an essential pubic service to the community of Fairbanks since the early 1950s. The power plant currently supplies steam and hot water to over 200 district heat customers in downtown Fairbanks and supplies electricity to the Golden Valley Electric Association, who in turn supply power to nearly 100,000 customers throughout Interior Alaska. The plant is currently capable of generating up to 27.5 MW of power. CPP has restricted operations and limited the amount of power generated during the summer months to below the capacity in order to meet the 2003 permit's effluent limitations. Modifying the effluent limitations in the current permit would enable the CPP to operate at its capacity throughout the year, improving service and stability to the local electrical grid.

Aurora Energy has a total workforce of 31 employees, which includes 25 plant workers and six managers. The average duration of employment for the company is nine years. Aurora Energy takes an active role in the community and has had representation in several local and national groups including the City of Fairbanks, Alaska Power Association, Downtown Association of Fairbanks, Fairbanks Chamber of Commerce, Alaska State Chamber of Commerce, American Coal Ash Association, Utility and Solid Waste Activities Group, Air and Waste Management Association, Fairbanks Economic Development Corporation, and the Chena River Front Commission.

The Department determined that the permitted activities are necessary to accommodate the important economic and social development in the area where the water is located and that the finding is satisfied.

2. **18 AAC 70.015 (a)(2)(B)**. Except as allowed under this subsection, reducing water quality will not violate the applicable criteria of 18 AAC 70.020 or 18 AAC 70.235 or the whole effluent toxicity limit in 18 AAC 70.030.

CWA §316(a) allows for variances from strict compliance with thermal water quality criteria. Permit applicants must submit supporting information outlined in regulations 40 CFR 125.72 and 73, which includes early screening information and a scientific investigation to demonstrate that a balanced, indigenous population would be maintained and protected to be considered for an alternative thermal criteria. Alternative thermal effluent limitations based on a thermal variance may be included in APDES permits if the discharger demonstrates that such effluent limitations are more stringent than necessary to assure the protection and propagation of a balanced, indigenous community of shellfish, fish, and wildlife in and on the body of water into which the discharge is made, taking into account the cumulative impact of its thermal discharge together with all other significant impacts on the species affected.

In the CPP's 2003 NPDES permit, EPA granted a thermal variance based on the absence of prior appreciable harm in lieu of predictive studies. Aurora Energy's 2016 permit reissuance application included a request for an alternative thermal effluent limitation above the level previously authorized, a request for a CWA §316(a) thermal variance, and a scientific study in support of the requests. The study, as described in detail in Appendix B, provided several lines of evidence to demonstrate that a balanced, indigenous population would be maintained and protected under increased cooling water discharge volume and temperature limits. DEC, in consultation with ADF&G, proposes to grant Aurora Energy a CWA §316(a) thermal variance.

DEC has not established a site-specific criterion under 18 AAC 70.235 for the Chena River near the discharge. Additionally, Alaska WQS and 18 AAC 70.030 require that an effluent discharged to a waterbody may not impart chronic toxicity to aquatic organisms at the point of discharge. A review of the CPP DMR data and results from analytical tests of the effluent taken in 2016 indicate that the main pollutant of concern in the effluent is temperature and pH to a much less extent. Given that non-contact cooling water is the waste stream discharged, the effluent has essentially the same composition as the water withdrawn from the Chena River except for the increase in temperature with very minor fluctuations in pH and is therefore characteristically not expected to be toxic. DEC concludes that no evidence exists that suggests the CPP will violate the Whole Effluent Toxicity (WET) limit in 18 AAC 70.030.

The Department determined that the reduction in water quality will not violate the water quality criteria in 18 AAC 70 or the WET limit in 18 AAC 70.030, and that the finding is satisfied.

3. **18 AAC 70.015(a)(2)(C)**. The resulting water quality will be adequate to fully protect existing uses of the water.

In accordance with CWA §316(a) and 18 AAC 70.220, DEC proposes to grant a permit variance from the temperature criteria in the Alaska WQS. The Chena River is protected for all designated uses including water supply, water recreation, growth and propagation of fish, shellfish, other aquatic life and wildlife. The discharge is expected to have no effect on the city's water supply as its main source of water is groundwater that is treated at the Golden Heart Utilities (GHU) Water Treatment Plant.

Aurora Energy conducted a scientific investigation to evaluate the potential effects of increasing the temperature of the effluent on fish and wildlife in compliance with their request for a thermal variance under CWA §316(a). The study determined that resident and migratory fish are the most susceptible to experiencing adverse effects from elevated water temperatures. Potential effects to spawning were not evaluated in the study because several field studies as well as observations by ADF&G confirmed that no spawning habitat is present near the CPP. Therefore, the study focused on potential impacts to fish during migratory periods.

Under normal weather conditions, the discharge is not expected to impact juvenile emigration or adult migration. During June and July, the discharge may increase the ambient river temperature downstream of the outfall to near 18°C (64.4°F). According to *EPA Region 10 Guidance for Pacific Northwest State and Tribal Temperature Water Quality Standards*, adult migration blockage conditions generally occur when temperatures reach 21°C (69.8°F) and they recommend a criteria not to exceed 20°C (68.0°F). Once fully mixed with the receiving water, the discharge is not expected to raise the ambient river temperature to this degree and indicates that the discharge would not create a permanent barrier to migration. Mixing modeling performed by the permittee and evaluated by DEC also demonstrates that there appears to be a migratory corridor in the river around the thermal plume.

DEC determined that the discharge will be adequate to fully protect existing uses of the water body and that the finding is satisfied.

4. **18 AAC 70.015(a)(2)(D)**. The methods of pollution prevention, control, and treatment found by the department to be most effective and reasonable will be applied to all wastes and other substances to be discharged.

By definition non-contact cooling water is solely heated water that does not come into direct contact with any raw material, intermediate product, waste project (other than heat), or finished product. CPP does not add any biocides, metallic cooling water additives, or other pollutants to the effluent or perform any pretreatment of the effluent to control chemical pollutants prior to discharge. With the exception of temperature and, to a lesser extent, pH, the effluent has the same composition as the water taken directly from the Chena River. Water quality sampling conducted in 2016 confirmed that pollutant levels, including biological oxygen demand, chemical oxygen demand, total organic carbon, total suspended solids, ammonia, pH, and chlorine, were found in the effluent at levels similar to background levels in the Chena River.

EPA promulgated an update to the Steam Electric Power Generating Point Source Category Effluent Limit Guideline (ELG) (found at 40 CFR Part 423), which contains limits for once through cooling water (i.e., "non-contact cooling water") and industrial waste streams (see Appendix B for more detail). Because the CPP discharges industrial and domestic waste generated at the facility to the City of Fairbanks GHU wastewater treatment facility, the only limits that apply to the CPP in this permitting action are those for once through cooling water.

The ELG prohibits the discharge of PCBs and contains an effluent limit for chlorine discharged in once through cooling water. As noted above, the CPP does not introduce chlorine to the effluent and water quality tests confirmed levels of chlorine were comparable to the river water, which was below the limit specified in the ELG. While the previous permit did not prohibit the discharge of PCBs, the reissued permit incorporates a prohibition on the discharge of PCBs as a permit condition as required by the ELG. Additionally, the permittee is required to implement a Best Management Practices (BMP) Plan that includes pollution prevention measures and controls to prevent/minimize the generation and release of pollutants from the CPP.

Aurora Energy analyzed the engineering and economic feasibility of several cooling technologies to identify any practicable alternatives to the use of once through cooling water at the CPP. None of the alternative cooling technologies were found to be feasible due to physical limitations, excessive costs, or other environmental impacts. The following summarizes the cooling technologies evaluated and results of the feasibility study:

- *Cooling Ponds*: A 27-acre cooling pond would be required to accommodate the CPP cooling needs. The CPP property, including the surrounding areas, is only 3.5 acres. Cooling ponds were found to be infeasible due to physical and size limitations.

- *Wet Cooling Towers*: EPA designated the Fairbanks North Star Borough, including the City of Fairbanks, as an air quality nonattainment area for 24-hour final particulate matters (PM2.5). Wet cooling systems add water vapor to the air that would likely exacerbate the air pollution issues by increasing ice fog formation in the winter months. Wet cooling towers were found to be infeasible due to health and safety concerns.

- *Dry Cooling*: Dry cooling would lower the CPP's overall energy efficiency and lower its output by approximately 14 percent. Compensating for the loss would require burning more coal, which is restricted under air quality regulations without offsetting emissions elsewhere within the non-attainment area. In addition, construction and installation of a dry cooling system is estimated to cost $24 million. These costs would be passed on to customers through rate hikes of up to 15 percent. The cost per MMBtu would surpass the cost of other fuels, which may lead customers to seek out less expensive sources of fuel to meet their home heating needs. Dry cooling was found to be infeasible due to the air quality restrictions as well as the overall costs.

- *Hybrid Cooling*: Construction and installation of a hybrid cooling system is estimated to be up to $20 million. As noted above for dry cooling, this would create a significant economic burden for Aurora Energy and their customers. Hybrid cooling was found to be infeasible due to overall costs.
- *Flow Augmentation*: Flow augmentation was found to be feasible from design/engineering perspective; however, it would increase maintenance costs due to variations in groundwater chemistry and necessitate securing groundwater rights. The existing ground water well is located on GHU's adjacent property and Aurora Energy would have to negotiate with GHU to gain access to the water. While an agreement can likely be reached, there is uncertainty regarding the volume of water that would be available as well as other unforeseen restrictions that may be placed on the use of the water well. Flow augmentation was found to be a feasible, but not practicable, option. The permit requires the permittee to conduct further analysis of this option.

DEC determined that the methods of pollution prevention, control, and treatment in the permit to be most effective and reasonable for applying to all wastes and substances discharged from the CPP, and the finding is satisfied.

5. **18 AAC 70.015(a)(2)(E)**. All wastes and other substances discharged will be treated and controlled to achieve (i) for new and existing point sources, the highest statutory and regulatory requirements; and (ii) for nonpoint sources, all cost-effective and reasonable best management practices.

The "highest statutory and regulatory treatment requirements" are defined in 18 AAC 70.990(30) (as amended June 26, 2003) and in the Interim Antidegradation Implementation Methods. Accordingly, the three parts of the definition are as follows:

A) Any federal technology-based ELG identified in 40 CFR 125.3 and 40 CFR 122.29, as amended through August 15, 1997, adopted by reference at 18 AAC 83.010(c)(9). The permit implements the applicable portions of the Steam Electric ELG at 40 CFR 423; therefore, this requirement is met.

B) Minimum treatment standards in 18 AAC 72.040. This part of the definition appears to be in error, as 18 AAC 72.040 describes discharges to sewers and not minimum treatment. The correct reference appears to be the minimum treatment standards found at 18 AAC 72.050, which refers to domestic wastewater discharges only. The CPP discharges its domestic wastewater to GHU; therefore, further analysis is not warranted for this finding.

C) Any treatment requirement imposed under another state law that is more stringent than requirements of this chapter.

This part of the definition includes any more stringent treatment required by state law, including 18 AAC 70 and 18 AAC 72. Neither the regulations in 18 AAC 15 and 18 AAC 72, nor another state law that the Department is aware of impose more stringent requirements than those found in 18 AAC 70. After review of the applicable statutory and regulatory requirements, including 18 AAC 70, 72, and 83, the Department finds that the discharge from CPP meets the highest applicable statutory and regulatory requirements and that this finding is satisfied.

9.0 Special Conditions

9.1 Cooling Water Intake Requirements

9.1.1 Statutory and Regulatory Basis

CWA §316(b) requires EPA to establish standards for cooling water intake structures (CWIS) that reflect the "best technology available (BTA) for minimizing adverse environmental impact". In 2014, EPA issued a final rule and regulations at 40 CFR 125.90 that established national requirements for existing power generating facilities and manufacturing facilities that are designed 1) to withdraw more than two million gallons per day (mgd) of water from waters of the U.S. and 2) to use at least 25 percent of the water they withdraw exclusively for cooling purposes. The purpose of the final rule is to reduce impingement and entrainment of aquatic organisms from CWIS. Facilities are required to reduce fish impingement and entrainment of aquatic organisms by ensuring that the location, design, construction, and capacity of the CWIS reflect the BTA for minimizing adverse environmental impact.

The rule includes a national BTA standard to address impingement mortality (IM) at existing CWIS and reflects EPA's assessment that impingement reduction technology is available, feasible, and demonstrated, and thus BTA for existing facilities. The IM standard at 40 CFR 125.94(c) is based on modified traveling screens with fish returns and provides facilities seven compliance alternatives that are equivalent or better in performance than modified traveling screens. To address potential entrainment-related impacts, the rule requires the Director to determine the BTA for an existing facility on a site-specific basis. The entrainment provision reflects EPA's assessment that there is no single BTA technology for entrainment at existing facilities, but instead a number of factors that are best accounted for on a site-specific basis. The BTA analysis must follow an established framework including consideration of site-specific factors and reflect a determination of the maximum reduction warranted after consideration of all relevant factors at the site.

9.1.2 Application Requirements

The CWA §316(b) rule requires that an owner or operator of a facility subject to the rule whose currently effective permit expires after July 14, 2018, submit information required in the applicable provisions of 40 CFR §122.21(r) when applying for permit reissuance. For those permits expiring prior to or on July 14, 2018, 40 CFR 125.95(2) allows the owner or operator of a facility to request an alternate schedule for the submission of the required information. The CPP permit expired in 2008 and was administratively extended. In their 2016 permit reissuance application, Aurora Energy submitted a portion of the data required including source water physical data, cooling water system data, CWIS data, and data on the facility's operational status. Aurora Energy was not able to develop the remaining information in a timely manner and requested additional time to submit the outstanding information. Per 40 CFR §125.95(a)(2), DEC finds the request for additional time reasonable and has extended the submittal date to be as soon as possible, but no later than 180 days prior to the expiration of the permit. When an alternate schedule has been established for submittal of the information required by the rule, 40 CFR §125.98(b)(5) requires the permitting authority to establish interim BTA requirements based on best professional judgment on a site-specific basis in accordance with 40 CFR §125.90(b) and 40 CFR §401.14.

9.1.3 Services Consultation

CWA §316(b) requires that DEC transmit permit applications for facilities subject to the rule to the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) (Services) prior to public notice of the draft or proposed permit, and provide each agency an opportunity to comment on federally-listed threatened and endangered (T&E) species and critical habitat in the area. The Services may also provide recommendations for inclusion in the permit that would minimize any incidental take of listed species, and/or avoid likely jeopardy to a listed species or destruction or adverse modification of critical habitat. CWA §316(b) provides the Services 60 days to review the permit application.

DEC contacted the Services on November 28, 2016, to determine if any T&E species or critical habitat are present near the outfall and provided them an opportunity to review Aurora Energy's complete permit reissuance application. On December 14, 2016, USFWS responded that they have no objection to reissuance of the permit and stated that no T&E species are present in the project area; therefore, they do not expect project-related activities to adversely affect listed species. USFWS recommended developing a monitoring program for fish impingement and entrainment at the intake/outlet that includes more frequent observations and identification of species found in the structure.

On February 9, 2017, NMFS responded that they do not expect any discernible effects to T&E species or critical habitat under their jurisdiction. NMFS did note that the river is Essential Fish Habitat (EFH) for chinook and chum salmon. NMFS made the following recommendations for addressing possible entrainment issues:

- Monitor the presence/absence of fry and juvenile salmon for one year near the intake (200 meters upstream and 100 downstream) and nearshore. Fry would be in the slowest currents and are usually measured by electrofishing; juveniles are commonly measured using baited minnow traps set overnight (20 to 24 hours). If there is no fry/juvenile sampled during usual outmigration periods, then the existing screens are deemed acceptable.
- If fry or small juveniles are present or the utility does not conduct the recommended salmon fry/juvenile presence/absence study, then NMFS recommends replacing the current screen size of the traveling screens with screen with 3/32 inch square holes. The less than 0.5 feet per second velocity cited in CWA §316(b) §125.94(c)(3) through the screen would still need to be met.

9.1.4 Impingement

Aurora Energy recorded the number of fish impingement mortalities observed during routine maintenance cleaning of the screens occurring between 2013 and 2015. Aurora Energy identified approximately 100 fish impingement mortalities per year in 2013 and 2014 with only 21 occurring in 2015. The reason for this sharp decline is not well understood. Some factors that may have influenced the results include irregular cleaning of the screen, intermittent flows that naturally rinsed the screen between cleanings, buildup of debris outside the intake structure that physically blocked access to the intake screen, or natural variation in the number of fish present per year. The results indicate overall low impingement mortality occurring because of the CPP's intake structure.

The permittee is required to collect impingement related data throughout the permit cycle to better assess the level of impingement and IM occurring at the CWIS. At a minimum, the permittee must record the number and species of organism removed from the screens, number of deceased organisms and percent IM, location of impingement, and the date the organisms were removed. Once the data has been collected and analyzed, DEC, in consultation with ADF&G, will determine the best technology available for minimizing impingement and IM at the facility.

The permittee must also identify the chosen method for compliance with the IM standard listed in 40 CFR 125.94(c) before expiration of the permit. If the option of using modified traveling screens or a system of technologies as the BTA for impingement mortality [(40 CFR 125.95(c)(5) or (6)] is chosen, the permittee must submit an impingement technology performance optimization study, which includes two years of biological data collection measuring the reduction in impingement mortality achieved by the modified traveling screens or systems of technologies and demonstrating that the operation has been optimized to minimize impingement mortality.

9.1.5 Entrainment

Entrainment is generally considered proportional to flow and therefore a reduction in flow results in a proportional reduction in entrainment. Operational practices such as scheduling regular maintenance shutdowns during periods when smaller organisms that can pass through the screen mesh are more likely to be present in higher numbers can reduce overall entrainment. Intake screens also provide some protection to larger fish from entrainment. The CPP's traveling screen has 3/8 inch square mesh. A smaller screen mesh size, while reducing entrainment, can increase impingement.

The 316(a) Thermal Variance Demonstration Study conducted by Aurora Energy evaluated the potential impact of the cooling water discharge on six biotic categories including phytoplankton, zooplankton, habitat formers, macroinvertebrates, fish, and other wildlife. The study found that although the phytoplankton and zooplankton communities in the Chena River are not well characterized, little evidence exists that indicate river systems similar to the Chena River support robust communities of phytoplankton or zooplankton. Visual observation and photo-documentation of the area near the CPP in 2016 revealed an absence of habitat formers in the area. Because the Chena River supports relatively low densities of plankton, zooplankton, and habitat formers, potential entrainment-related impacts on the river ecosystem are expected to be low for these species. Larger species of macroinvertebrates, fish, and other wildlife are not considered to be at risk for entrainment at the CPP because they generally would not pass through the 3/8 inch square mesh on the travelling screen. However, salmon fry and small juveniles may pass through the 3/8 inch square mesh.

The permittee is required to collect entrainment related data throughout the permit cycle to better assess the level of entrainment occurring at the cooling water intake structure. At a minimum, the permittee must record the presence or absence of fry and juvenile fish in the vicinity of the intake structure and nearshore and the numbers and types of organisms entrained. Once the data has been collected and analyzed, DEC, in consultation with ADF&G, will determine the best technology available for minimizing entrainment at the facility. The permittee is also required to submit other entrainment-related data to DEC as soon as possible, but no later than 180 days before the expiration of the permit. Other entrainment-related information required includes the impact of changes in particulate emission or other pollutants associated with entrainment technologies, land availability as is related to the feasibility of entrainment technology, remaining useful plant life, and quantified and qualitative social benefits and costs of available entrainment technologies

9.1.6 Interim Best Available Technology Determination

DEC has determined that the current configuration of the CWIS and operational practice of scheduling regular shutdowns when fish are likely present are reasonable measures to minimize adverse environmental impact resulting from impingement and entrainment. DEC has therefore incorporated these measures as site-specific CWA §316(b) BTA interim cooling water intake requirements at Permit Section 2.0. The interim requirements at Permit Part 2.1.3 satisfy the interim BTA requirements at 40 CFR §125.98(b)(5) described above.

In addition to the studies required to complete the permit application, the permittee is required to collect that data listed in Permit Parts 2.1.4 and 2.1.5 as discussed above to quantify impingement and entrainment impacts occurring at the CWIS. The permittee must submit the permit application requirements and the results of additional studies to DEC as soon as possible but no later than 180 days before the expiration of the permit.

9.2 Thermal Plume Study

In 2016, Aurora Energy included in their permit reissuance application a request for a CWA §316(a) thermal variance with proposed alternative thermal effluent limits above the levels currently authorized in their existing permit and the results of a scientific study they conducted to evaluate the potential impacts of the thermal plume on the local aquatic community (refer to Appendix B for a detailed summary of the study). The study was largely based on the results of a simulation model (using CORMIX), a thorough literature review of data pertaining to temperature's effect on fish behavior and migration, and EPA's *Region 10 Guidance for Pacific Northwest State and Tribal Temperature Water Quality Standards* policy document.

Based on the finding that a balanced, indigenous population would be maintained and protected, DEC proposes to grant the thermal variance in the permit. During the five-year permit cycle, DEC is requiring Aurora Energy to perform additional studies aimed at validating the simulation model and better understanding the thermal plume's effect on fish behavior including migration.

The objectives of the study are to:

- Observe fish behavior during migratory periods in relation to the thermal plume;
- Analyze water quality within and near the plume; and
- Evaluate the mixing characteristics of the thermal plume during the summer months.

The Thermal Plume Study requires completion of the following four tasks as soon as possible during the first spring and summer (May-July) after CPP begins operating at 27.5 MW. The permittee must submit a work plan to DEC for approval before beginning the studies. DEC will coordinate its review with ADF&G.

Task 1: Monitor Fish Behavior and Migration

Task 1 involves monitoring the movements of fish using sonar at locations upstream and downstream of the outfall. According to field observations by ADF&G, no suitable spawning habitat is present in the area of the outfall and salmon spawn upstream of the outfall. In order to reach upstream spawning grounds, fish must migrate through the thermal plume and past the CPP. Historical evidence suggests fish have been successful migrating past the CPP for several decades, but no formal studies have been conducted to compare the number of fish attempting to migrate past the CPP and those successfully migrating past the CPP, reaching spawning grounds, and spawning. Direct observation of fish movements is necessary for determining whether the increased temperature effluent limits and the resulting thermal plume have a potential impact on fish populations in the Chena River.

Stipulations: Monitoring must be performed during the spring and summer months (May-July) when juvenile and adult King Salmon and Arctic Grayling are expected to be migrating past the CPP.

Task 2: Field Sampling and Laboratory Analysis

Task 2 involves monitoring temperature, pH, and dissolved oxygen within and around the thermal plume. The CORMIX model simulated the mixing characteristics of the thermal plume, estimated the temperatures of the plume within the near and far-fields, identified the point at which the thermal plume is expected to be fully mixed with the receiving water, and indicated zones of passage for migratory fish exist below and to the north of the thermal plume in the receiving water. Measuring the water quality within the thermal plume will provide real-time information that can be used to further characterize the extent of the thermal plume and validate the results of the simulation model.

Stipulations: At a minimum, monitoring stations must be placed at the following locations:

- Outfall;
- Within the modeled thermal plume midway between the outfall and the point the plume is expected to be fully mixed with the receiving water;
- On the streambed underneath the modeled thermal plume before the point the plume is expected to be fully mixed with the receiving water; and
- North of the modeled thermal plume before the point the plume is expected to be fully mixed with the receiving water.

Task 3: Thermal Imagery

Task 3 involves obtaining aerial thermal imagery to map the size and spatial distribution of the thermal plume. Characterizing the thermal plume is necessary for understating how the thermal plume mixes with the receiving water under extreme conditions, validating modeling results and for evaluating the potential impact of the thermal plume on the aquatic community.

Stipulations: The thermal imagery must be obtained during the month of July when the ambient temperature in the Chena River is expected to be highest.

Task 4: Data Analysis and Final Report

Task 4 involves analyzing the data obtained from Tasks 1-3 and providing DEC and ADF&G a final report summarizing the data and conclusions regarding the validity of the thermal plume and assumptions made in the CWA §316(a) demonstration study used to support the thermal variance. The results of the study will be used to further evaluate the effluent limits and thermal plume authorized in the APDES permit.

Stipulations: The final report must be submitted to DEC and ADF&G within six months of concluding Tasks 1-3. DEC may request one round of changes prior to report finalization.

9.3 Flow Augmentation Feasibility Study

Flow augmentation is the process of adding (colder) groundwater to the effluent to lower its temperature prior to discharging it into a receiving water. As part of their permit reissuance application, Aurora Energy evaluated the feasibility of using flow augmentation to decrease the temperature of the effluent and found it to be impractical for several reasons. Because the nearest groundwater source is located on the adjacent GHU property, CPP would have to secure water rights and/or purchase water from GHU. Without an agreement in place, CPP cannot be certain that adequate water would be available on a consistent basis to serve the needs of CPP. Another concern is that the groundwater chemistry may have a negative effect on CPP’s once through cooling system. The permit requires the permittee to further study the feasibility of using flow augmentation to mitigate excessive temperature in the effluent. The study must consider the environmental, economic, and engineering feasibility of using flow augmentation, the sufficiency of other technology-based treatment options, and the preferred economic and environmental method to mitigate excessive temperature in the effluent. The permittee must submit to DEC a draft study plan for approval prior to beginning the study and submit the study to DEC as soon as possible but no later than 180 days prior to the permit's expiration.

9.4 Quality Assurance Project Plan

The permittee is required to develop procedures to ensure that the monitoring data submitted are accurate and to explain data anomalies if they occur. The permittee is required to update the Quality Assurance Project Plan (QAPP) within 180 days of the effective date of the final permit. Additionally, the permittee must submit a letter to DEC within 180 days of the effective date of the permit stating that the plan has been implemented within the required period. The QAPP shall consist of standard operating procedures the permittee must follow for collecting, handling, storing and shipping samples, laboratory analysis, and data reporting. The plan shall be retained on site and made available to the Department upon request.

9.5 Best Management Practices Plan

In accordance with AS 46.03.110(d), the Department may specify in a permit the terms and conditions under which waste material may be disposed. This permit requires the permittee to develop a BMP Plan in order to prevent or minimize the potential for the release of pollutants to waters and lands of the State of Alaska through plant site runoff, spillage or leaks, or erosion. The permit contains certain BMP conditions that must be included in the BMP plan. The permit requires the permittee to develop or update and implement a BMP plan within 180 days of the effective date of the final permit. The permittee must submit a letter to DEC within 180 days of the effective date of the permit stating that the plan has been implemented within the required period. The Plan must be kept on site and made available to the Department upon request. Because the permit does not authorize the discharge of storm water, the permit removed the requirement for storm water discharged to be included in the BMP Plan.

9.6 Standard Conditions

Appendix A of the permit contains standard regulatory language that must be included in all APDES permits. These requirements are based on the regulations and cannot be challenged in the context of an individual APDES permit action. The standard regulatory language covers requirements such as monitoring, recording, reporting requirements, compliance responsibilities, and other general requirements.

10.0 Reporting and Recordkeeping

10.1 Discharge Monitoring Report

By the 15th day of the month, the permittee must submit to DEC a DMR summarizing the results of monitoring occurring over the previous month. The permittee must use a DMR form that is provided by DEC or a DEC-approved equivalent that provides comparable information. If the permittee monitors the influent, effluent, or receiving water characteristics more frequently than required by the permit, the permittee must include the results in the calculation of the data included in the DMR.

10.2 Annual Report

By March 15 of each calendar year, the permittee shall submit an Annual Water Quality Monitoring Summary Report summarizing all effluent and receiving water quality monitoring results that occurred over the previous year.

10.3 Records Retention

The permittee must retain permit records for a minimum of five years from the date of the application, report, sample, or measurement. At a minimum, the permittee must keep a copy of the permit and supporting information used to complete the permit application, all reports required by the permit, monitoring information, and DMRs.

10.4 Electronic Reporting (E-Reporting) Rule

The Permittee is responsible for electronically submitting DMRs and other reports in accordance with 40 CFR §127. The start dates for e-reporting are provided in 40 CFR §127.16. DEC has established a website at http://dec.alaska.gov/water/Compliance/EReportingRule.htm that contains general information. As DEC implements the E-Reporting Rule, more information will be posted on this webpage. The permittee will be further notified by DEC in the future about how to implement the conditions in 40 CFR §127.

11.0 Other Legal Requirements

11.1 Endangered Species Act

The Endangered Species Act (ESA) requires federal agencies to consult with the USFWS and the National Oceanic and Atmospheric Administration (NOAA) NMFS if their actions could beneficially or adversely affect any T&E species or their habitats. NMFS is responsible for administration of the ESA for listed cetaceans, seals, sea lions, sea turtles, anadromous fish, marine fish, marine plants, and corals. All other species (including polar bears, walrus, and sea otters) are administered by the USFWS.

As a state agency, DEC is not required to consult with USFWS or NMFS regarding permitting actions; however, DEC interacts voluntarily with these federal agencies to obtain listings of T&E species and critical habitat. DEC contacted USFWS and NMFS on November 28, 2016, and requested them to identify any T&E species under their jurisdiction near the wastewater discharge outfalls. On December 14, 2016, USFWS responded by stating that no T&E species are present in the project area. On February 9, 2017, NMFS responded by stating that they do not expect the discharge to cause any discernible effects to T&E species or critical habitat under NMFS's jurisdiction.

An interactive endangered species map maintained by NMFS may be accessed at http://alaskafisheries.noaa.gov/mapping/esa/ The USFWS has further information regarding ESA at http://www.fws.gov/alaska/fisheries/endangered/index.htm.

11.2 Essential Fish Habitat

EFH includes the waters and substrate (sediments) necessary for fish from commercially fished species to spawn, breed, feed, or grow to maturity. Aurora Energy conducted a field study in 2015 to determine if spawning habitats suitable for Arctic Grayling and salmon existed near the outfall or downstream during low flow conditions. The study found that riffle habitat, preferred by Arctic Grayling, is not present near the outfall, and is present approximately 1,100 feet downstream. Because riffle habitat is generally signified by shallow, turbulent water, they concluded that riffle habitats would no longer exist when water levels increase in the spring and summer months, which coincide with Arctic Grayling spawning periods. The ADF&G agrees with the assertion that riffles that could be used by spawning Arctic grayling are likely not present during spring runoff conditions when Arctic grayling are known to spawn. The ADF&G also has no evidence of spawning by Chinook or chum salmon within the lower Chena River, which includes the area downstream of the CPP discharge. While fish migration and rearing does occur through this area, the ADF&G has not recorded any adverse effects on fish due to the increased temperatures near the outfall.

The Magnuson-Stevens Fishery Conservation and Management Act (January 21, 1999) requires federal agencies to consult with NMFS when a proposed discharge has the potential to adversely affect (reduce quality and/or quantity of) EFH. As a state agency, DEC is not required to consult with NMFS regarding permitting actions; however, DEC interacts voluntarily with NMFS. On November 28, 2016, DEC requested NMFS to identify any EFH under their jurisdiction near the wastewater discharge outfalls.

On February 9, 2017, NMFS responded by stating the Chena River is EFH for chinook and chum salmon as both species migrate upstream and downstream of the CPP, but they do not expect the discharge to cause any discernible impacts to EFH.

11.3 Permit Expiration

The permit will expire five years from the effective date of the permit.

REFERENCES

1. Alaska Department of Environmental Conservation, 2003. *18 Alaska Administrative Code 70 Water Quality Standards,* as amended through June 26, 2003.
2. Alaska Department of Environmental Conservation, 2003. *Alaska Water Quality Criteria Manual for Toxics and Other Deleterious Organic and Inorganic Substances*, as amended through December 12, 2008.
3. Alaska Department of Environmental Conservation, 2010. Alaska's Final 2010 Integrated Water Quality Monitoring and Assessment Report, July 15, 2010.
4. Alaska Department of Environmental Conservation, 2010. Interim Antidegradation Implementation Methods, July 14, 2010.
5. Alaska Department of Environmental Conservation and Tanana Valley Watershed Association, 2011-12. Water Quality Sampling in Three Water Bodies, June 2011-July 2012. Project ACWA 12-07.
6. Alaska Department of Fish and Game, 2016. *Fish Resource Monitor* webpage. http://extra.sf.adfg.state.ak.us/FishResourceMonitor/?mode=awc. Accessed December 1, 2015.
7. Alaska Department of Fish and Game, 1992. *Influence of Temperature on Freshwater Fishes: A Literature Review with Emphasis on Species in Alaska,* May 1992. Technical Report 91-1.
8. Alaska Department of Fish and Game, 2009. *Sport Fishery Management Plan for Chinook Salmon in the Chena and Salcha Rivers,* March 2009. Fishery Management Report No. 09-11.
9. Alaska Department of Fish and Game, 2016. *E-mail from Jack Winter to Angela Hunt*, dated December 10, 2015, regarding Chinook and Chum salmon spawning within the lower Chena River.
10. Aurora Energy, 2015. *Field Report: Chena River Stream Habitat Observations during Low Flow Conditions*, March 20, 2015.
11. Aurora Energy, 2001. *Preliminary Evaluation of Aurora Energy's Thermal Discharge to the Chena River,* February 2001.
12. Aurora Energy, 2016. *Memorandum to Audra Brase, Alaska Department of Fish and Game, Proposed Temperature Criteria for Evaluating Potential Impacts to Salmonids from the Thermal Effluent of Chena Power Plant,* September 2016.
13. Richter, A., and Kolmes S.A., 2005. *Maximum Temperature Limits for Chinook, Coho, and Chum Salmon, and Steelhead Trout in the Pacific Northwest,* 2005. Reviews in Fisheries Science 13, 1:26-49.
14. National Marine Fisheries Service, 2017. *E-mail from Jeanne Hanson to Angela Hunt*, dated February 9, 2017, regarding threatened and endangered species, essential fish habitat, and Clean Water Action Section 316(b) transmittal of permit application documents.
15. U.S. Army Corps of Engineers, Alaska District, 2012. *Moose Creek Dam Chena River Lakes Flood Control Project*, *Project Operational Review and Dam Safety Overview*, August 2012.
16. U.S. Army Corps of Engineers, Alaska District, 2012. Fact Sheet, *Moose Creek Dam Interim Risk Reduction Measures*, January 2012.
17. U.S. Environmental Protection Agency, 1977. *Interagency 316(a) Technical Guidance Manual and Guide for Thermal Effects Sections of Nuclear Facilities Environmental Impact Statements,* May 1977. Office of Water Enforcement, Washington, D.C.
18. U.S. Environmental Protection Agency. Memorandum to Water Management Division Directors, Region 1-10 NPDES State Directors, *Interim Guidance on Implementation of Section 402(o) Anti-backsliding Rules for Water Quality-Based Permits.* Office of Water, Washington, D.C.

19. U.S. Environmental Protection Agency, 2008. Memorandum to Water Division Directors, Regions 1-10, *Implementation of Clean Water Act Section 316(a) Thermal Variances in NPDES Permit (Review of Existing Permits)*, October 2008. Office of Water, Washington, D.C.
20. U.S. Environmental Protection Agency, 2003. *EPA Region 10 Guidance for Pacific Northwest State and Tribal Temperature Water Quality Standards*. EPA-910-B-03.002. Region 10 Office of Water, Seattle, WA.
21. U.S. Environmental Protection Agency, 2010. *NPDES Permit Writers' Manual*, September 2010. EPA-833-K-10-001. Office of Wastewater Management, Washington D.C.
22. U.S. Environmental Protection Agency, 2001. *Salmonid Behavior and Water Temperature,* May 2001. EPA-910-D-01-001. Issue Paper 1. Region 10 Office of Water, Seattle, WA.
23. U.S. Environmental Protection Agency, 2001. *Summary of Technical Literature Examining the Physiological Effects of Temperature on Salmonids*, May 2001. Technical Issue Paper 5. Region 10 Office of Water, Seattle, WA.
24. U.S. Environmental Protection Agency, 2014. *Technical Development Document for the Final Section 316(b) Existing Facilities Rule*, May 2014. EPA-821-R-14-002
25. U.S. Environmental Protection Agency, 2011. *Watershed Characterization for the Chena River Watershed, Alaska.* Region 10 Office of Water, Seattle, WA.
26. U.S. Fish and Wildlife Service, 2016. *E-mail from Charleen Buncic to Angela Hunt*, dated December 14, 2016, regarding threatened and endangered species, essential fish habitat, and Clean Water Action Section 316(b) transmittal of permit application documents.
27. Usibelli Coal Mine, Inc., 2013. *Energy and Economic Impacts of Coal in Interior Alaska,* November 2013.
28. Usibelli Coal Mine, Inc., 2015. *Statewide Socioeconomic Impacts of Usibelli Coal Mine, Inc.,* January 2015.
29. U.S. Geological Survey, 2000. *Preliminary Hydraulic Analysis and Implications for Restoration of Noyes Slough, Fairbanks, Alaska,* 2000.Water-Resources Investigations Report 00-4227. Anchorage, Alaska

APPENDIX A. FACILITY INFORMATION

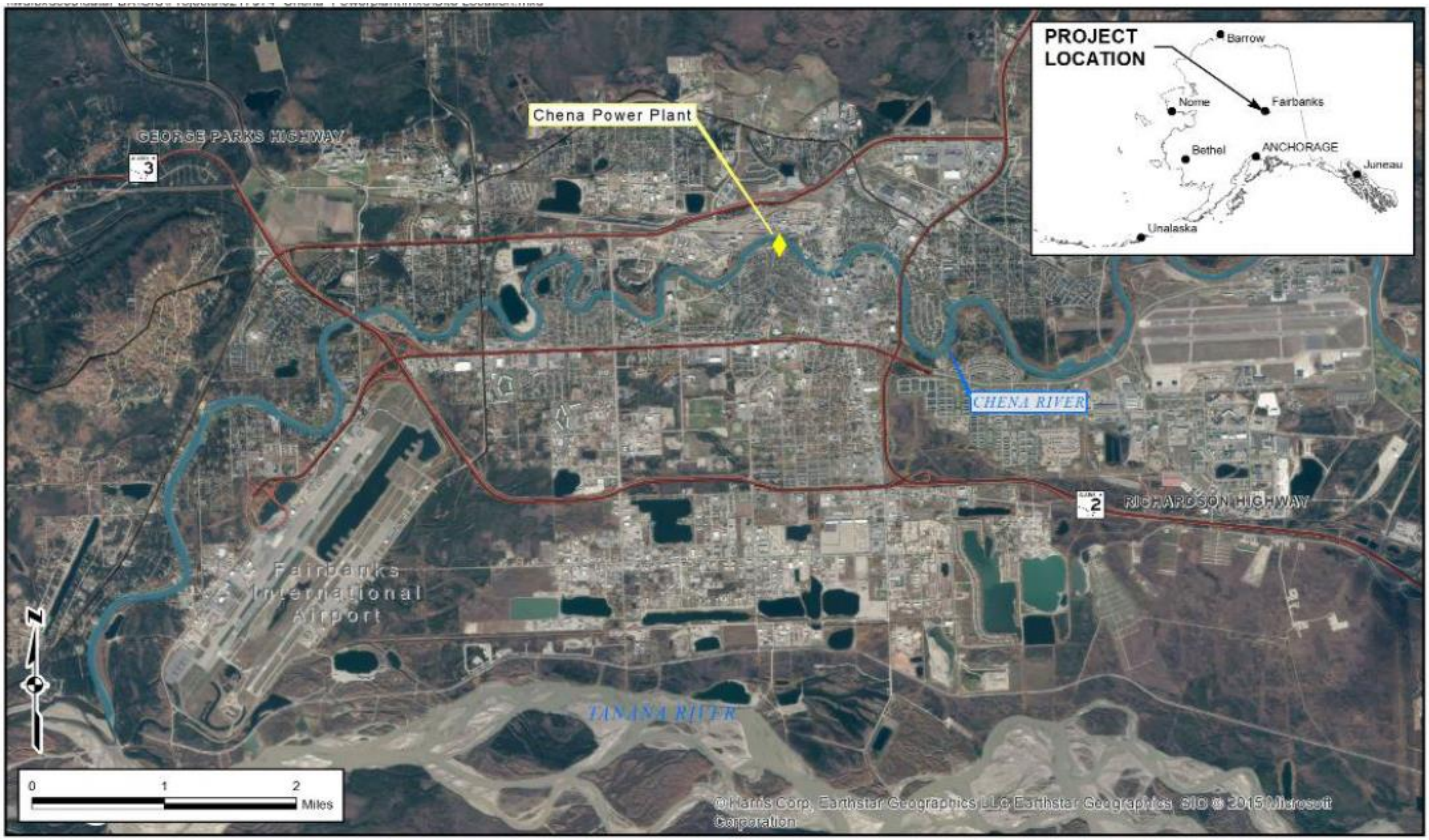


Figure A-1 Chena Power Plant Location and Vicinity

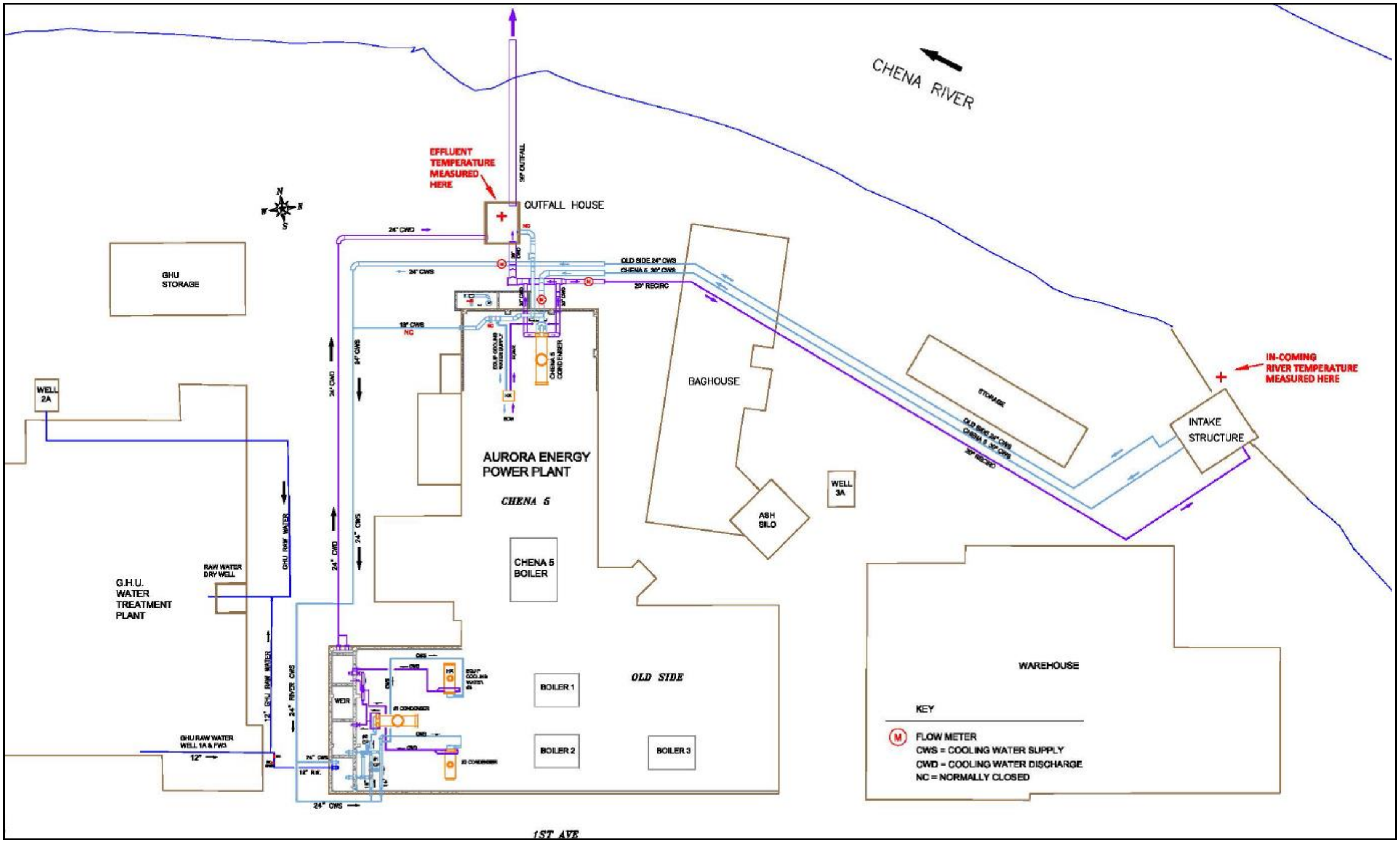
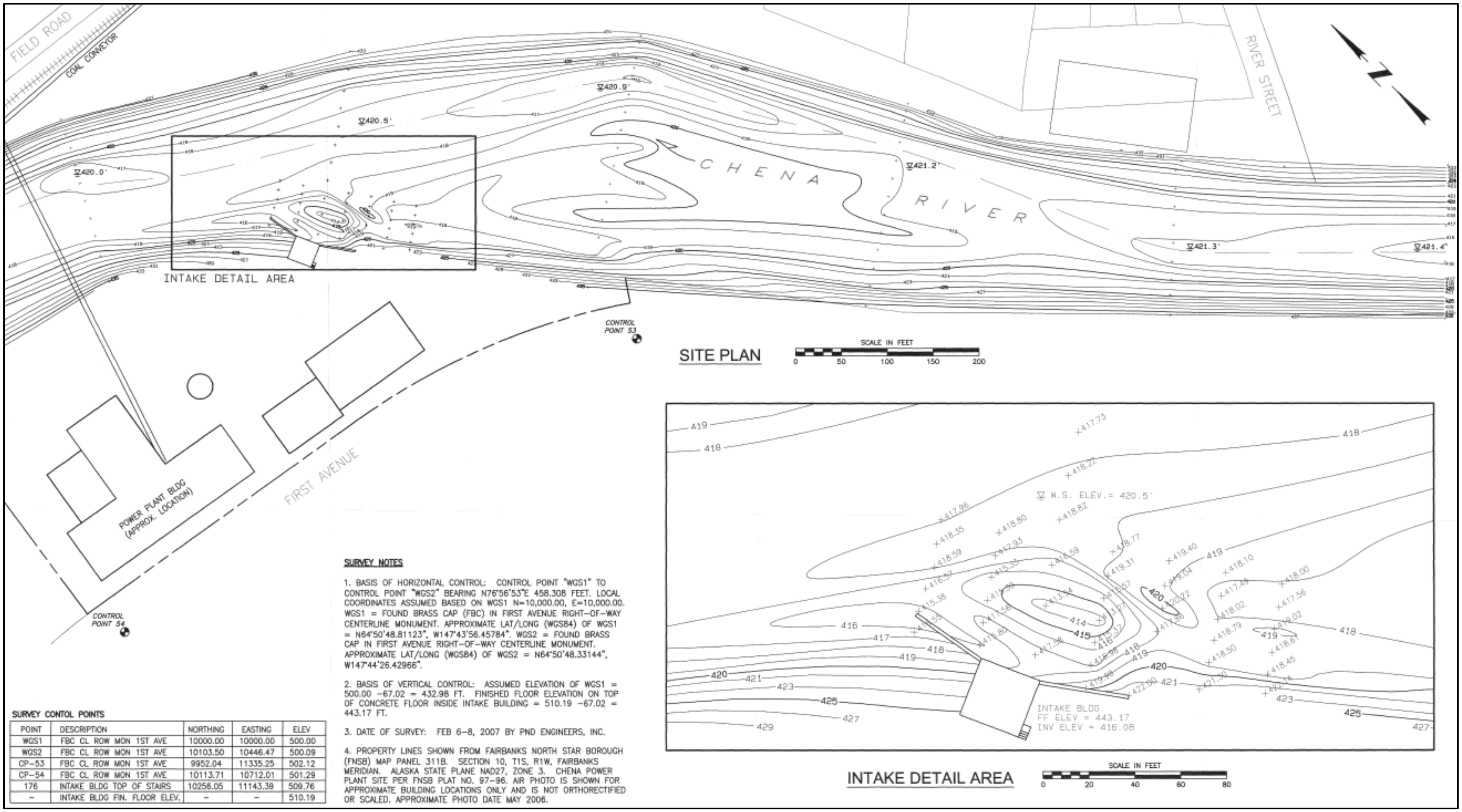


Figure A-2 Chena Power Plant Site Plan



SURVEY NOTES

1. BASIS OF HORIZONTAL CONTROL: CONTROL POINT "WGS1" TO CONTROL POINT "WGS2" BEARING N76°56'53"E 458.308 FEET. LOCAL COORDINATES ASSUMED BASED ON WGS1 N=10,000.00, E=10,000.00. WGS1 = FOUND BRASS CAP (FBC) IN FIRST AVENUE RIGHT-OF-WAY CENTERLINE MONUMENT. APPROXIMATE LAT/LONG (WGS84) OF WGS1 = N64°50'48.81123", W147°43'56.45784". WGS2 = FOUND BRASS CAP IN FIRST AVENUE RIGHT-OF-WAY CENTERLINE MONUMENT. APPROXIMATE LAT/LONG (WGS84) OF WGS2 = N64°50'48.33144", W147°44'26.42966".

2. BASIS OF VERTICAL CONTROL: ASSUMED ELEVATION OF WGS1 = 500.00 −67.02 = 432.98 FT. FINISHED FLOOR ELEVATION ON TOP OF CONCRETE FLOOR INSIDE INTAKE BUILDING = 510.19 −67.02 = 443.17 FT.

3. DATE OF SURVEY: FEB 6–8, 2007 BY PND ENGINEERS, INC.

4. PROPERTY LINES SHOWN FROM FAIRBANKS NORTH STAR BOROUGH (FNSB) MAP PANEL 311B. SECTION 10, T1S, R1W, FAIRBANKS MERIDIAN. ALASKA STATE PLANE NAD27, ZONE 3. CHENA POWER PLANT SITE PER FNSB PLAT NO. 97-96. AIR PHOTO IS SHOWN FOR APPROXIMATE BUILDING LOCATIONS ONLY AND IS NOT ORTHORECTIFIED OR SCALED. APPROXIMATE PHOTO DATE MAY 2006.

SURVEY CONTOL POINTS

POINT	DESCRIPTION	NORTHING	EASTING	ELEV
WGS1	FBC CL ROW MON 1ST AVE	10000.00	10000.00	500.00
WGS2	FBC CL ROW MON 1ST AVE	10103.50	10446.47	500.09
CP-53	FBC CL ROW MON 1ST AVE	9952.04	11335.25	502.12
CP-54	FBC CL ROW MON 1ST AVE	10113.71	10712.01	501.29
176	INTAKE BLDG TOP OF STAIRS	10256.05	11143.39	509.76
–	INTAKE BLDG FIN. FLOOR ELEV.	–	–	510.19

Figure A-3 Cooling Water Intake Location

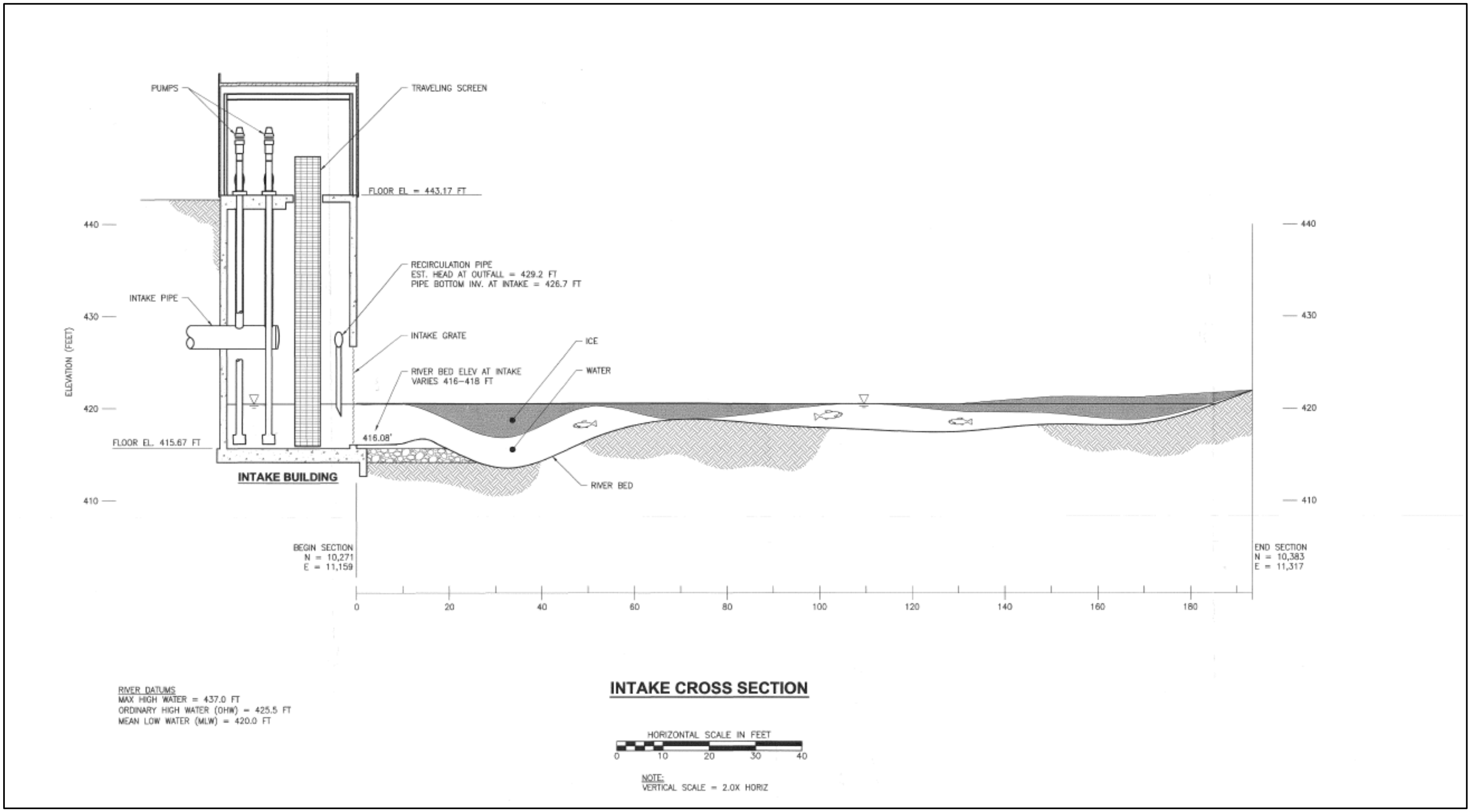


Figure A-4 Cooling Water Intake Cross Section

APPENDIX B. BASIS FOR EFFLUENT LIMITATIONS

The Alaska Department of Environmental Conservation (DEC or the Department) prohibits the discharge of pollutants to waters of the United States per Title 18 of the Alaska Administrative Code (AAC) §83.015 unless DEC issues an Alaska Pollutant Discharge Elimination System (APDES) permit that meets the purpose of Alaska Statutes (AS) 46.03 and Clean Water Act (CWA) §402. Per these statutory and regulatory requirements, the permit includes effluent limits that require the permittee to (1) meet standards reflecting levels of technological capability, (2) comply with 18 AAC 70 – Alaska Water Quality Standards (WQS), and (3) comply with other state requirements that may be more stringent.

CWA §301(b) requires that all permits contain effluent limitations that control the discharge of conventional, nonconventional, and toxic pollutants by March 31, 1989. Effluent limitations are any restriction placed on the quantity, discharge rate, and concentration of pollutants discharged from point sources into waters of the United States. The Environmental Protection Agency (EPA) develops national effluent limit guidelines (ELG) that establish performance standards for specific industrial sectors to ensure that industrial facilities with similar characteristics meet similar effluent limitations representing the best pollution control technologies or pollution prevention practices regardless of their location or the nature of the receiving water into which the discharge is made. ELGs are technology-based standards and are intended to represent the pollutant reductions that are economically achievable for an industry. They can include numeric and narrative limitations, including best management practices, to control the discharge of pollutants. Technology based-effluent limits (TBELs) for industrial wastewater discharges are set at several levels of control:

- *BPT/Best Practicable Control Technology Currently Available* - applies to all types of pollutants and are based on the average performance of well-operated facilities in each industrial category;
- *BCT/Best Conventional Pollutant Control Technology* - applies to conventional pollutants and are based on facility performance and a cost reasonableness test;
- *BAT/Best Available Technology Economically Achievable* - applies to non-conventional and toxic pollutants and are based on the performance associated with the best control and treatment measures that facilities in an industrial category are capable of achieving;
- *NSPS/New Source Performance Standards* - applies to new dischargers and are based on the best available demonstrated control technology;
- *PSNS/Pretreatment Standards For New Sources* - applies to new indirect dischargers to wastewater treatment facilities and are based on best available demonstrated control technology;
- *PSES/Pretreatment Standards For Existing Sources* - applies to existing indirect dischargers to wastewater treatment facilities and are based on best available demonstrated control technology.

In situations where ELGs have not been developed or have not considered specific discharges or pollutants, a regulatory agency can develop TBELs using best professional judgement on a case-by-case basis. ELGs may not limit every parameter that may be present in the effluent. ELGs are often established only for those pollutants that are necessary to ensure that industrial facilities comply with the technology-based requirements of the CWA. When ELGs do not exist for a particular pollutant expected to be in the effluent, DEC must determine if the pollutant may cause or contribute to an exceedance of a water quality (WQ) criterion for the waterbody. If a pollutant causes or contributes to an exceedance of a WQ criterion, a water quality-based effluent limit (WQBEL) for the pollutant must be established in the permit. A WQBEL is designed to ensure that WQS are maintained and the waterbody as a whole is protected. WQBELs may be more stringent than TBELs. In cases where both TBELs and WQBELs have been generated, the more stringent of the two limitations will be selected as the final permit limitation.

B.1 Technology-Based Effluent Limitations

B.1.1 Steam Electric Effluent Limitation Guidelines

On September 30, 2015, EPA promulgated an update to the Steam Electric Power Generating Point Source Category Effluent Limit Guideline, which can be found at 40 Code of Federal Regulations (CFR) Part 423. The Steam Electric Power Generating Point Source Category ELGs regulate discharges from the operation of generation units primarily engaged in the generation of electricity for distribution and sale, which results primarily from utilizing fossil-type fuel in conjunction with a thermal cycle employing the steam water system as the thermodynamic medium.

The steam electric ELG contains limits for BPT, BAT, NSPS, PSES, and PSNS. A new source is any stream electric power generating facility constructed after September 30, 2015. The Chena Power Plant (CPP) has been operating since the 1950s; therefore, the CPP is considered an existing rather than a new source. CPP's regulated discharges include flows of once through cooling water (i.e., non-contact cooling water) directly into the Chena River and flows of other industrial waste streams that discharge to the City of Fairbanks Golden Heart Utilities (GHU) wastewater treatment facility.

As an existing source subject to the ELG, CPP is regulated under BAT, BPT, and PSES. The BAT and BPT effluent limits both prohibit the discharge of polychlorinated biphenyl (PCB) and contain an equivalent limit for chlorine discharged in once through cooling water. The once through cooling water used at CPP is not exposed to equipment or materials that would introduce pollutants into the effluent and no chlorine or other biocides are added to the effluent. Water quality sampling conducted in 2016 confirmed that pollutant levels, including biological oxygen demand (BOD), chemical oxygen demand (COD), total organic carbon (TOC), total suspended solids (TSS), ammonia, pH, and chlorine, were found in the effluent at levels similar to background levels in the Chena River. Because the CPP does not add chlorine to the effluent, the only BPT/BAT limit that applies to the discharge is the prohibition on PCBs. While the previous permit did not prohibit the discharge of PCBs, the proposed permit incorporates a prohibition on the discharge of PCBs as a permit condition as required by the ELG.

The PSES establishes limits for pollutants generated from several waste streams including metal cleaning wastes, cooling tower blowdown, flue gas desulfurization wastewater, fly ash and bottom transport water, flu gas mercury control and gasification wastewater. CPP does not generate cooling tower blowdown or chemical metal cleaning waste; therefore, those standards are not applicable. The waste streams CPP generates include water purification system regeneration waste, boiler blow down, and ash handling system waste. The water purification system regeneration waste is collected in a neutralization tank that is pH adjusted prior to discharging to the sanitary sewer. All of the waste streams, including water purification system regeneration waste, process backwash, boiler blowdown, and other less significant waste streams are combined prior to being discharged to the sanitary sewer.

CPP discharges all of its industrial and domestic waste to the GHU Wastewater Treatment Plant in accordance with GHU's approved Pretreatment Program. GHU's Pretreatment Program, approved by EPA in 1985, regulates discharges into their wastewater treatment plant and grants GHU the authority (referred to as the "Control Authority") to permit discharges, inspect and monitor industrial facilities discharging into the sanitary collection system, and enforce effluent limits. In 1998, GHU issued Aurora Energy an Industrial Wastewater Discharge Permit to discharge wastewater into their system. The permit includes a combination of local and federal requirements (whichever are more stringent) and established limits for 25 potential pollutants such as metals, oil and grease, pH, PCBs, TSS, BOD, and temperature. Aurora Energy has generally met the permits limits with only minor and/or temporary exceedances.

B.2 Water Quality – Based Effluent Limitations

B.2.1 Statutory and Regulatory Basis

Per 18 AAC 70.010, a person may not conduct an operation that causes, or contributes to, a violation of the WQS. 18 AAC 15.090 requires that permits include terms and conditions to ensure criteria are met, including operating, monitoring and reporting requirements. The regulations require the permitting authority to make this evaluation using procedures that account for existing control on point and nonpoint sources of pollution, the variability of the pollutant in the effluent, species sensitivity (for toxicity), and where appropriate, dilution in the receiving water.

Per 18 AAC 83.435, DEC must implement CWA §301(b)(1)(C), which requires that APDES permits include limits for all pollutants or parameters which "are or may be discharged at a level which will cause, have the reasonable potential to cause, or contribute to an excursion above any state WQS, including state narrative criteria for water quality". The limits must be stringent enough to ensure that WQS are met and must be consistent with any available waste load allocation (WLA).

In order to determine if WQBEL's are needed and to develop those limits when necessary, DEC typically conducts a reasonable potential analysis (RPA). The RPA is a water quality-based analysis that identifies the applicable water quality criteria, determines if there is a "reasonable potential" for the discharge to cause or contribute to an excursion of WQS in the receiving water, and develops effluent limits, if needed. Based on the effluent limits in the previous permit and the facility's temperature performance monitoring data demonstrating permit limitation exceedances, DEC concluded there is "reasonable potential" for the effluent temperature to exceed WQS in the Chena River.

CWA §316(a) and the regulations at 40 CFR 122.21(m)(6) as well as state regulations at 18 AAC 70.220 provide for variances from strict compliance with thermal (i.e., temperature) water quality criteria. Regulations for submitting and reviewing thermal discharge variance requests are promulgated at 40 CFR Part 125, subpart H. Permit applicants must show that they are eligible to receive an alternative thermal effluent limit under CWA §316(a) and submit supporting information outlined in 40 CFR 125.72 and 73. In general, the supporting information includes early screening information and a scientific investigation to demonstrate that a balanced, indigenous population would be maintained and protected. Existing dischargers may base their demonstration upon the absence of prior appreciable harm in lieu of predictive studies.

Alternative thermal effluent limitations based on a thermal variance may be included in permits if the discharger demonstrates that such effluent limitations are more stringent than necessary to assure the protection and propagation of a balanced, indigenous community of shellfish, fish, and wildlife in and on the body of water into which the discharge is made, taking into account the cumulative impact of its thermal discharge together with all other significant impacts on the species affected. In CPP's 2003 NPDES permit, EPA granted a thermal variance under CWA §316(a) based on the absence of prior appreciable harm in lieu of predictive studies. EPA's regulatory rationale for authorizing the variance was based on a demonstration of the absence of prior appreciable harm in lieu of predictive studies. EPA considered several factors including observations that 1) past occurrence of the thermal discharge from the CPP had not been documented to have adverse impact on the indigenous and anadromous populations of aquatic life in the Chena River, and 2) any fish resident or migrating through the area of discharge would have escape routes from the increased temperatures associated with the outfall.

Aurora Energy's 2016 permit reissuance application included a request for an alternative thermal effluent limitations above the levels previously authorized in their permit and a CWA §316(a) demonstration study in support of the request. They requested to increase the summer maximum daily discharge limit from 87.3°F (30.7°C) to 95.0°F (35.0°C) and the summer average monthly discharge limit from 79.9°F (26.6°C) to 90.0°F (32.2°C). They also requested to increase the summer total discharge from 20 million gallons per day (mgd) to 24 mgd. According to Aurora Energy, the increased effluent limitations will allow the CPP to operate at its capacity throughout the year, which the CPP has not sustained due to the restrictive nature of the effluent limitations in the previous 2003 permit.

Aurora Energy's demonstration study describes the Chena River's hydrologic characteristics, effluent characteristics, aquatic communities and representative important species (RIS), a summary of related scientific literature, and potential impacts of the thermal discharge on the aquatic community. The demonstration study was conducted in accordance with EPA's *Interagency 316(a) Technical Guidance Manual and Guide for Thermal Effects of Nuclear Facilities Environmental Impact Statement,* 1977, and is summarized below.

B.2.2 CWA Section 316(a) Demonstration

B.2.2.1 Chena River Characteristics

The Chena River is a clear-running stream that emerges in the White Mountains and drains the Yukon-Tanana Uplands. The channel flows west approximately 150 miles until it merges with the Tanana River. The present-day channel of the Chena River near downtown Fairbanks originally existed as a branch of Tanana River known as the Chena Slough, and was renamed the Chena River after 1950. The portion of the Chena system near Fairbanks has experienced significant changes from its historical condition.

In the 1930s, increasing flows in the slough led scientists to believe that the Tanana River was attempting to establish a new channel that encompassed the slough to the north through Fairbanks. To prevent the formation of a new channel, the Moose Creek Dike was built across the slough in 1945 to reduce flows to the slough from the Tanana River. In 1967, Fairbanks suffered a severe flood that spurred the Chena River Lakes Flood Control Project aimed at preventing future flooding of the city. The flood control project included a diversion dam and control structure (Moose Creek Dam) on the slough upstream of Fairbanks, a floodway and spillway leading to the Tanana River, and a raised levee along the north side of the Tanana River. As flows to the slough from the sediment-laden Tanana River were eliminated, the Chena system near Fairbank underwent substantial changes, most notably the transition to a clear-running waterway by the 1950s. CPP began operating and discharging once through cooling water to the Chena River in 1952.

Today the Chena River remains a clear-running channel that flows through downtown Fairbanks before merging with the Tanana River downstream of Fairbanks. While the river was once fed by the Tanana River, it is now fed by groundwater and precipitation. The river is approximately 9.5 feet deep and exhibits variations in seasonal flow with the lowest flows occurring during the winter months and the highest flows occurring during spring, with a gradual tapering down over summer and fall. Ambient water temperatures range from near freezing in the winter to greater than 59°F (15°C) in the summer.

B.2.2.2 Current Effluent Description

The outfall is an open 36-inch pipe located midway across the river bottom (Figure B-1). Approximately 20 mgd of once through cooling water is discharged from the CPP throughout the year, which is less than five percent of the flow in the Chena River. The effluent temperature varies based on the discharge volume; however, the change in temperature between the influent and effluent is generally 28°F (15.6°C) in the winter and 30°F (16.7°C) in the summer. No chemicals or other constituents are added to the effluent during the cooling cycle, therefore the effluent is identical in composition to the Chena River water. The effluent is not treated prior to discharge.

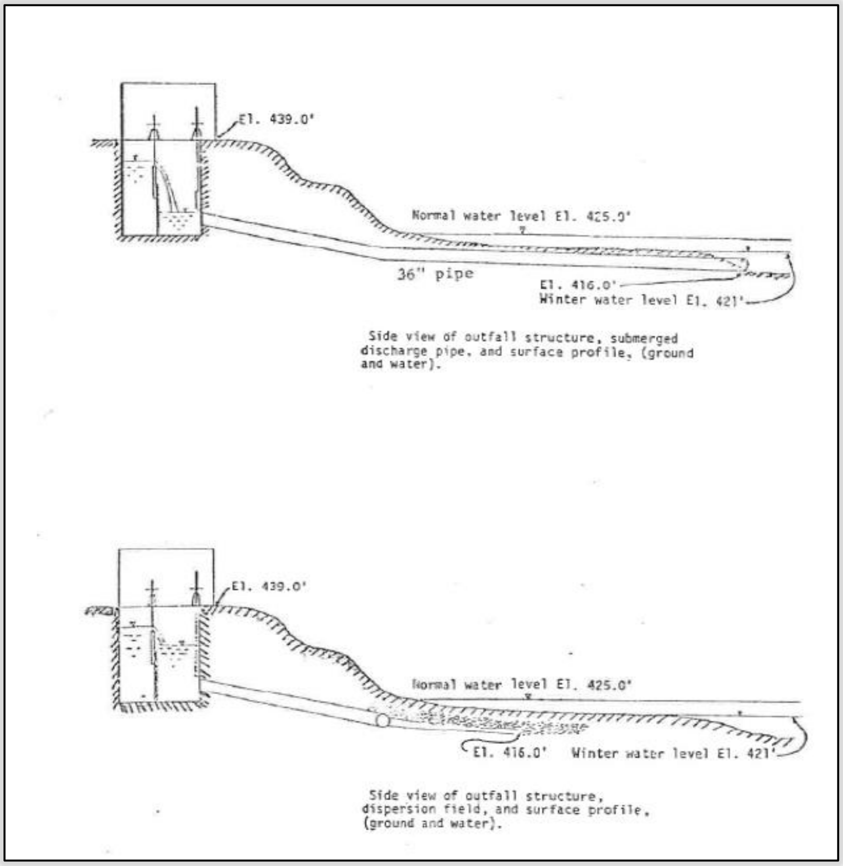


Figure B-1 Outfall Structure

B.2.2.3 Proposed Effluent Limits

Aurora Energy requested the following modification to the effluent limitations in the revised permit (summarized in Table B-1 below with changes bolded):

- Reassigning May to the summer period for purposes of determining compliance;
- Increasing the maximum daily and monthly average temperature limits during the summer; and
- Increasing the daily volumetric flow from 20 mgd to 24 mgd.

Table B-1 Comparison of Current and Proposed Effluent Limits

Effluent Parameter	Current Effluent Limitations		Proposed Effluent Limitations	
	Max Daily Limit	Average Monthly Limit	Max Daily Limit	Average Monthly Limit
Flow	20 mgd	Report	24 mgd	Report
Temperature Winter (Oct-May)	Oct – May 25.6°C (78.1°F)	Oct – May 22.6°C (72.7°F)	Oct – April 25.6°C (78.1°F)	Oct – April 22.6°C (72.7°F)
Temperature Summer (June-Sept)	June – Sept 30.7°C (87.3°F)	June – Sept 26.6°C (79.9°F)	June – Sept 35.0°C (95°F)	June – Sept 32.2°C (90°F)
pH	6.5 - 8.5 at all times		6.5 - 8.5 at all times	

B.2.2.4 Cooling Water Discharge Mixing Characteristics

The demonstration study included simulation models using CORMIX to predict how the cooling water mixes with the receiving water and to assess the potential effect of the effluent on the Chena River's thermal regime considering four different scenarios. The parameters used to model the four scenarios relied on conservative ambient river temperatures and flow conditions to help ensure the potential impacts were conservatively modeled. Effluent temperatures were based on proposed and current operational configurations. The results from the model describe mixing in two distinct study areas, the near-field and far-field regions. The input parameters for the four scenarios are listed in Table B-2.

Table B-2 Four Scenarios Used to Assess Potential Impacts to Chena River

Scenario	Month	River Flow, 7Q10, cfs	85th Percentile Ambient Temperature	Effluent Volume, mgd	Effluent Temperature
A	May[a] (spring)	737	10.9°C (51.62°F)	24	27.57°C (81.63°F)
B	July[b] (summer)	759	15.8°C (60.44°F)	24	32.47°C (90.45°F)
C[c]	July[b] (extreme summer)	759	17.3°C (63.14°F)	24	33.97°C (93.15°F)
D	July[b] (current summer)	759	15.8°C (60.44°F)	20	31.8°C (89.24°F)

Notes:
a. corresponds with the period of juvenile salmon emigration
b. corresponds with the period of adult salmon migration to upstream spawning sites
c. 7-Day Average Maximum Temperature

Near-Field Region

The near-field region is the zone of strong initial mixing that extends from the outfall to the point at which the plume is fully laterally and vertically mixed. The thermal plumes in the near-field region act similarly in all four scenarios with respect to geometries and temperature gradients. In general, the simulations show that the effluent plume initially exists perpendicular to the ambient flow and travels across the river after emerging from the discharge pipe. Because the plume is discharged at a higher velocity than the river water, turbulent mixing of the plume into ambient water rapidly occurs. As the plume loses its initial momentum, the ambient cross flow deflects the plume and carries it downstream. The modeling depicts the thermal plume to initially mix vertically, and then stratify approximately 170-270 feet downstream before resuming vertical mixing. The simulations also show that the plume is buoyant and rapidly rises to the surface while hugging the south river bank immediately adjacent to the CPP.

The simulation indicates that the heated effluent begins to dissipate within 10-25 meters (32-82 feet) of the outfall and is confined to a limited cross-sectional area of the river. By the time the plume reaches 250 meters (820 feet) downstream, the plume is approximately 2.0°C (3.6°F) to 3.0°C (5.4°F) or less above ambient water temperatures. By 500 meters (1640 feet) downstream, the plume is approximately 1.0°C (1.8°F) to 1.5°C (2.7°F) above ambient water temperatures. Because the plume stays closer to the south bank, its influence on temperatures along the opposite bank are minimal with a slight rise of 0.1°C (0.2°F).

Far-Field Region

The far-field region is the location where the thermal plume becomes fully mixed with the receiving water and represents uniform concentrations and temperature gradients in both lateral and vertical directions. The far-field region extends downstream to the confluence of the Chena and Tanana rivers. The simulations did not include heat loss from the water's surface to prevent overestimation of the fully mixed temperatures. When the thermal plume is fully mixed with the receiving water downstream of the outfall, the simulation models indicate that the ambient river temperature increases 0.69°C (1.26°F) under current conditions and is predicted to increase 0.80°C (1.44°F) in the spring and extreme summer conditions. Table B-3 shows the estimated changes to ambient river temperatures for the four scenarios.

Table B-3 Predicted Increases in Ambient River Temperatures

Scenario	Month	Chena River Temp	Fully-Mixed Change in Temp Downstream of Outfall	River Temperature Fully-Mixed Downstream of Outfall	Distance Downstream to Fully-Mixed Conditions, ft
Scenario A	May[a] (spring)	10.9° C (51.62° F)	0.8° C (1.44° F)	11.7° C (53.06° F)	1782
Scenario B	July[b] (summer)	15.8° C (60.44° F)	0.78° C (1.44° F)	16.6° C (61.88° F)	2061
Scenario C	July[b] (extreme summer)	17.3° C (63.14° F)	0.8° C (1.44° F)	18.1° C (64.58°F)	2367
Scenario D	July (current summer)	15.8° C (60.44° F)	0.69° C (1.26° F)	16.5° C (61.70°F)	1796

Notes:
a. corresponds with the period of juvenile salmon emigration
b. corresponds with the period of adult salmon migration to upstream spawning sites

B.2.2.5 Representative Important Species

The EPA *Interagency 316(a) Technical Guidance Manual* recommends evaluating six broad biotic categories[1] to determine the Representative Important Species (RIS) for a particular site. The selection of RIS is based on the assumption that all organisms that might be considered "important" and/or "representative" usually cannot be studied in detail and a smaller list of species is often adequate for study purposes. For each biotic category subject to negative impacts, a RIS is chosen as a surrogate for the biotic category because it has similar biological requirements to other species in the biotic category. Protection of RIS is expected to assure protection of other species at the site.

Aurora Energy's CWA §316(a) scientific study evaluated each of the six biotic categories for their presence and potential for sustaining impacts from the cooling water discharge. The study indicated that fish have the highest risk of experiencing adverse impacts from the discharge. The researchers found

[1] phytoplankton, zooplankton, habitat formers, shellfish/macroinvertebrates, wildlife, and fish

that little data is available on phytoplankton in the area, but believe they are not generally found in streams such as the Chena River as the food chains in similar systems are based on detrital materials rather than phytoplankton. Similarly, the zooplankton community in the Chena River is not well defined; however, no commercially important, rare, or endangered species are known to the present. Visual observations and photo-documentation of the area failed to identify a significant community of habitat formers. Several species of macroinvertebrates are present in the vicinity including *Chironmidae*, *Oligochaeta*, and *Ephhemeroptera, plecoptera, trichoptera* (EPT taxa). While macroinvertebrates are present, the discharge is unlikely to cause a reduction in the standing crop or alter the community structure due to the limited contact between the plume and the river sediments. Due to the limited amount of habitat in the area and heavy development adjacent to the river, the potential that wildlife would be adversely effected by the discharge is minimal.

Unlike the other biotic categories, the Chena River supports a robust fishery. The Chena River supports numerous resident and anadromous fish populations including chinook salmon (*Oncorhynchus tshawytscha*), chum salmon (*Oncorhynchus keta*), Arctic Grayling (*Thymallus arcticus*), northern pike (*Esox luscious linnaeus*), sheefish (*Stendous leucichthys nelma*), burbot (*Lota lota*), arctic lamprey (*Lampetra japonica*), slimy sculpin (*Cottus cognatus*), and lake chub (*Couesius plumbeus*). Field studies conducted in 2015 confirmed that no spawning areas (i.e., suitable habitat) are present within the power plant's area of discharge influence. Of the fish species residing in the river, the RIS selected for further study were Arctic Grayling, chinook salmon, and chum salmon. Being the species most susceptible to experiencing negative effects from a heated discharge, these fish species are the focus of the predictive demonstration that aims to evaluate if the thermal changes are substantial enough to harm fish populations, especially during migratory periods.

B.2.2.6 Thermal Effects

Water temperature is a critical factor in maintaining strong fish populations due to its profound influence on their distribution, growth, reproduction, and overall survival. Changes in water temperature outside a fish's optimal range can alter its metabolic processes and lead to such adverse effects as lowered resistance to certain diseases and parasite infections, increased susceptibility to predation, variation in the timing of smolting and spawning, impaired egg development, and mortality. NMFS and USFWS have identified increased water temperatures as one of the primary factors associated with the decline of several threatened and endangered fish species, including chinook salmon, steelhead, and bull trout, throughout the Pacific Northwest.

To assess the potential for fish to sustain adverse effects from increases in water temperatures, Aurora Energy's demonstration study included an extensive review of relevant regulatory guidance and peer-reviewed literature to evaluate how fish may be affected by temperatures and determine their thermal tolerances. Because no spawning areas are known to exist near the CPP, the review focused on potential impacts to swimming and evasive behavior, adult and juvenile migration, lethality, and shock. The primary guidance used in the study was *EPA Region 10 Guidance for Pacific Northwest State and Tribal Water Quality Standards* (USEPA, 2003) and *Summary of Technical Literature Examining the Physiological Effects of Temperature on Salmonids* (USEPA 2001). These documents provide temperature criteria for salmonids and a summary of current temperature-related data and its effect on salmonids. EPA's Region 10 guidance states that adult migration blockage and delay occurs at 21-22°C (69.8–71.6°F) and recommends a maximum (i.e., not to be exceeded) seven-day average of daily maximum (7DADM) of 20°C (68.0°F) for salmon migration. The guidance states "a 20°C (68.0°F) criterion would protect migrating juveniles and adults from lethal temperatures and would prevent migration blockage conditions."

The literature review consisted of a database query using keywords pertaining to thermal effects studies on Arctic Grayling and salmon, the Chena River, and subarctic rivers. Articles containing relevant information on one of the RIS, water temperature data associated with measured or observed responses in fish, temperature effects on migration, and exposure duration were selected for further review. A total of 98 abstracts were reviewed and 28 potentially applicable articles were selected for detailed review. The literature reviewed for this study provided information from several stocks of fish each with unique seasonal temperature-dependent preferences from different geographical regions including Alaska, the Pacific Northwest, and the northern Rocky Mountain region. Due to this natural variation, the data presented in the literature provided a wide range of temperature thresholds where impacts have been observed or are predicted.

Fish Behavior

Fish are cold-blooded organisms (ectotherms) that use reactive and predictive behavioral means to adjust to evolving environmental conditions to enhance their long-term survivability. Most fish rely on water temperature to provide cues that stimulate certain behaviors that help them perform essential functions such as regulating their body temperature within narrow limits, locating prey, avoiding predators, migrating, and spawning. In fact, water temperature is the most influential factor in determining fish behavior in salmonids. Fish show acute thermal preferences and will actively avoid areas outside of their preferred thermal ranges when colder water is available. The temperature at which fish use avoidance behavior is strongly influenced by the acclimation history of the fish. The acute preference temperature of salmonids increases with increasing acclimation temperature. In general, salmon begin to show avoidance behavior at temperatures greater than 15°C (59.0°F).

Due to this avoidance behavior and the cooling water mixing characteristics, it is unlikely that fish swimming behavior would be adversely effected by the heated discharge. Because the plume is buoyant (rises shortly after entering the river) and narrow relative to the river channel, fish can find refuge in colder water below and alongside the thermal plume (within zones of passage) in areas where the thermal plume has yet to fully mix with river water. Once the thermal plume is fully mixed with river water downstream of the discharge, the temperature is generally at or below the range of observable behavioral changes.

Migration

Migration Periods

The primary migration period for juvenile and adult salmon in the Chena River is between May and July. Juvenile chinook and chum salmon emigration has not been studied extensively, but it is believed that both species begin outmigration to the ocean prior to or during the spring thaw, which usually falls within the month of May. Studies on the effect of temperature on the smolting process show that elevated temperature during the smolting process can cause a variety of adverse effects such as lethality, premature smolting, inhibition, or reversal of smoltification, blockage of seaward migration, and other stresses detrimental to fitness. The literature indicates that the smolting process may be impaired at temperatures ranging from 12.0-20.0°C (53.6-68.0).

Adult chinook salmon enter the Chena River between late June and mid-July. Adult chum salmon enter the Chena River in early July and have been observed passing the Moose Creek Dam upstream of the

CPP by mid-July. Arctic Grayling reside in the Chena River, but juveniles and adults have been known to migrate to spawning grounds within their home stream as well as adjacent stream systems before returning to feeding areas.

Temperature Criteria

Specific temperature criteria were chosen for juveniles and adults to evaluate the potential impact to fish migration resulting from the thermal discharge. Little data exists that directly assesses juvenile emigration and EPA documentation does not make a recommendation on a minimum temperature threshold in their Region 10 guidance document. Therefore, the Alaska WQS of 15°C (59.0°F) was chosen as the temperature criteria for evaluating potential migration impacts to juvenile salmonids.

During the summer months when adult migration is occurring, the ambient temperature in the Chena River periodically exceeds 15°C (59.0°F), although it does not appear to deter salmon from migrating upstream to their spawning grounds. For adult salmonids, 18°C (64.4°F) was the most conservative criterion identified in the literature and was chosen as the temperature criteria for evaluating potential impacts to adults. While a criterion of 18°C (64.4°F) is lower than EPA Region 10 recommended criteria of 20°C (68.0°F), using a more conservative criterion is expected to account for regional and seasonal fluctuations in river flows and temperature variations and help ensure protective temperatures are attained under fully mixed conditions.

Adult Arctic Grayling have been observed migrating upstream to smaller tributaries during periods when the main channel had record low flows and ambient temperatures exceeding 18°C (64.4°F), which is considered to indicate a migratory barrier. Similar to adult salmonids, a temperature criterion of 18°C (64.4°F) was chosen to evaluate potential migration impacts.

Migration Effects

Aurora Energy's demonstration study compared the temperature criteria [15°C (59.0°F) for juveniles and 18°C (64.4°F) for adults] to the results of the mixing simulation model (i.e., CORMIX) to evaluate the potential impacts to fish migration from the thermal discharge. The study showed that impacts to migration would most likely to occur in the summer during periods of extreme low flows and high ambient temperatures. Migration impacts to juvenile salmon are not anticipated because juveniles migrate past the CPP earlier in the year when ambient temperatures are low and the temperature under fully mixed conditions is expected to be 11.7°C (53.1°F), which is well below the temperature criteria of 15°C (59.0°F) and below the range of observed impacts to smoltification.

To evaluate potential migration impact to adults, the demonstration study focused on plume geometry and thermal gradient to determine if zones of passage exist that fish could use to move around the thermal plume before it fully mixes with river water. The simulation model shows that the plume near the CPP (near field) does not extend laterally across the stream, but rather remains closer to the south bank, providing a zone of passage with colder water to the north. The plume is also buoyant and rises toward the surface, providing a zone of passage with colder water under the thermal plume prior to fully mixing. When the discharge has fully mixed laterally and vertically with the river water (far-field) downstream and fish cannot use evasive behavior to avoid elevated temperatures, the temperature is estimated to be 16.7°C (62.1°F) under warmer than average ambient river temperatures and low flows. Because this is based on warmer than average ambient river temperatures, it is assumed to be protective during natural yearly fluctuations. When ambient river temperatures are extremely high, the fully mixed temperature is estimated to be 18.1°C (64.4°F), which is slightly above the temperature criteria used to evaluate adult migration. Although migration impact could occur during these extreme events, they are expected to be rare and short-lived, resulting in a short-term stall to migration as opposed to a permanent barrier.

The demonstration study also showed a high degree of similarity between the thermal plume resulting from the current discharge conditions and the proposed conditions in July. Assuming the fish using the Chena River have acclimated and evolved with the temperature patterns in the river, the study concludes that the proposed discharge is not likely to change fish behavior or preclude migration.

Current July Discharge ***Proposed July Discharge***

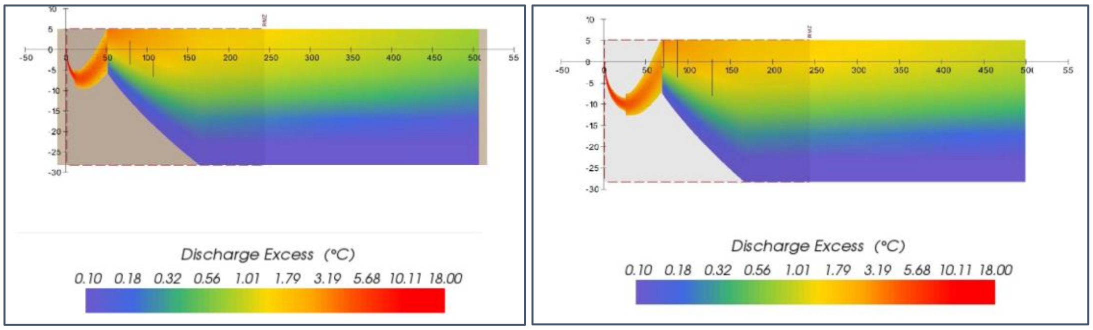


Figure B-2 **Plume Geometry of the Current and Proposed Discharge in July**

Lethality and Shock

Lethality varies based on the duration of exposure and period of acclimation prior to exposure. The standard measure for lethal effects is the upper incipient lethal temperature, which is the temperature that 50 percent of the fish can tolerate for seven days. The literature indicated that lethal temperatures for all juvenile salmonids generally ranged from 23°- 26°C (73.4°-78.8°F) and for adults ranged from 21° to 22°C (69.8-71.6°F). The report *Influence of Temperature on Freshwater Fishes: A Literature Review with Emphasis on Species in Alaska* indicates that the upper lethal temperature for salmonids can be as low as 20°C (60.8°F); however, fish will exhibit avoidance when temperatures are within 2-3°C (3.5-5.4°F) of the lethal temperatures. Because fish are expected to use evasive behaviors to avoid elevated temperatures near the outfall, lethality is generally not expected to occur. However, fish that are present in the thermal plume near the outfall could be exposed to heated water above this range and either be killed or experience thermal shock.

The literature states that exposure to 32°C (89.6°F) water for less than 10 seconds can be lethal and fish exposed to short-term increases to 26-30°C (78.8-86.0°F) may experience thermal shock. To limit fish mortality from lethal temperatures, EPA Region 10 guidance recommends that the maximum temperature within the plume after 2 seconds should not exceed 32°C (89.6°F). To reduce the chances of thermal shock, EPA recommends that the cross-sectional area of the plume that exceeds 25°C (77.0°F) be limited to 5 percent or less of the total river width. The simulation model indicates that under the worst-case scenario the water temperature within 2 seconds after discharge would be 26.2°C (79.2°F), which is lower than EPAs recommendation of 32°C (89.6°F) and suggests that fish using evasive behaviors would not likely be exposed to lethal temperatures near the outfall. The model simulation also shows that approximately 5 percent or less of the plume’s cross-sectional area contains temperatures in excess of 25°C (77.0°F).

B.2.2.7 Conclusion

Aurora Energy's CWA §316(a) study provided several lines of evidence to support their request for a thermal variance from effluent limitations. The application study demonstrated that a balanced, indigenous population would be maintained and protected under increased cooling water discharge volume and temperature limits. The historical record indicates that the current populations of fish adapted to the thermal discharge as the river was undergoing substantial changes and transitioning to a clear-running stream. Despite a lack of data documenting the fishery or stream conditions prior to thermal discharge, observation by the ADF&G suggest that the discharge has not harmed fish populations in the Chena River. EPA concurred with this conclusion and in the 2003 NPDES permit granted a thermal variance based on a determination of no prior harm.

After reviewing several biotic categories, the study found that chinook and chum salmon and Arctic Grayling are the species most susceptible to adverse effects from the thermal discharge during migratory periods. Based on the literature reviewed as part of the study, a temperature criterion of 15°C (59.0°F) for juveniles and 18°C (64.4°F) for adults was used to evaluate the potential impact to migration. A simulation model was used to estimate river temperatures under different flow and ambient temperature scenarios near the outfall and downstream. The model simulation shows that the discharge is not expected to impact juvenile migration. When juvenile outmigration is occurring in the spring, the discharge would have little effect on river temperatures due to low ambient temperatures and the fully mixed temperature would remain well below the temperature criteria of 15°C (59.0°F).

When adult migration is occurring in the summer months, fish have clear zones of passage around and/or under the plume and can avoid exposure to heated water until the plume fully mixes with the river water. Under normal conditions, the fully mixed temperature downstream is estimated to be 16.7°C (62.1°F), which is below the threshold of observable migration impacts. Under extreme conditions (lowest flow and highest ambient temperature), the fully-mixed temperature downstream is estimated to be at or slightly above the temperature threshold of 18°C (64.4°F), indicating that it is possible the discharge could have a minor impact on adult migration by causing temporary (but not permanent) cessation of migration downstream of the outfall.

Although the potential exists for the increased discharge limits to temporarily impact migration during extreme events, the simulation model shows that the thermal mixing characteristics of the proposed discharge is very similar to the current discharge. As previously discussed, fish are believed to have acclimated to the current thermal discharge without ill effects. In addition, the temperature criteria used in the study is a conservative (minimum) threshold for evaluating migration impacts that is below what most studies have observed as well as EPAs recommended threshold of 20°C (68.0°F).

DEC consulted with ADF&G regarding the potential impacts to fish resulting from the proposed increased thermal effluents limits. ADF&G stated that the Chena River salmon fishery has been in decline over the last decade and that encouraging chinook salmon returns is a high priority to the agency. The specific cause is expected to be a combination of numerous smaller impacts simultaneously taking place throughout the river system. ADF&G also stated that salmon have continued to migrate past CPP despite the thermal discharge and the increased thermal effluent limits are not expected to significantly change migration patterns. However, ADF&G recommended that Aurora Energy conduct a field study to evaluate the potential impacts of the thermal plume on fisheries. The permit requires Aurora Energy to conduct a study over the course of the permit term to characterize the thermal plume and analyze its potential impact on fish behavior including migration (see Permit Part 2.2 and Fact Sheet

Section 9.2 for a description of the study requirements). Depending on the outcome of the study, DEC will adjust the effluent limitations as necessary in subsequent permit reissuance(s) to ensure ongoing maintenance and protection of aquatic habitat and resources. Given the evidence presented in the scientific study conducted by Aurora Energy and ADF&G's input, DEC proposes to grant a thermal variance for CPP.